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CHINESE FOREST TREES AND TIMBER SUPPLY

VIEW FROM SUMMIT OF MO-ÊRH SHAN, SHENSI.

CHINESE FOREST TREES AND TIMBER SUPPLY

BY

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Author of

"THE SOYA BEAN OF MANCHURIA"
"A PRODUCTION MAP OF CHINA"
"MANCHURIAN TUSSORE SILK"

WITH A MAP AND 33 ILLUSTRATIONS

T. FISHER UNWIN
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I DEDICATE THIS BOOK

TO

THE RIGHT HONOURABLE SIR E. M. SATOW, G.C.M.G.

AND TO

A. ALLAN SHAND, Esquire

MY FATHER'S FRIENDS

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INTRODUCTION

INTRODUCTION

SINCE the closing years of the nineteenth century economists have drawn attention to the rapid depletion of the world's timber supply through reckless cutting and wasteful methods of distribution, and those who have studied the question closely go so far as to prophesy a world timber famine in the course of a few decades unless steps are taken at once to find a remedy. It is in the newer lands that this destructive policy has been carried on, but the present paper deals with the ancient State of China, where the same problem has been acute for a long period. With the awakening of the national consciousness is arising the desire to develop China's resources for the good of her own people, and to effect this one of the first measures to be taken in hand is assuredly that of preserving and developing the woods and forests. In the hope that any gain in knowledge of the data of this question may be

of some small use towards the solution of this problem, so fraught with consequences of vital importance for millions of mankind, the author has devoted his leisure time for several years to the work of compiling the facts here recorded.

With regard to the deforestation of China a host of foreign observers—travellers, missionaries, or officials—has for upwards of a century borne witness to the fact, and deplored the consequences which have brought disaster time and again. The naturalist Fortune comments on the bareness of the southern coast provinces, and the Abbé David refers to the sad deforestation in the north, while the geologist Richthofen laments the same phenomenon in various parts of the country. The journal *Notes and Queries* contains, in a number published in 1869, an admirable statement of the condition of affairs at that time, which seems worth quoting in full: "In a thickly populated and highly cultivated country like China but few remnants are found of the original forests, and these few owe their preservation to the vicinity of the monasteries, the sacred character of the localities, and the, in this case, very useful ideas of *fungshui;* but the

TEMPLE PRESERVE, WESTERN HILLS, PEKING.

sentimental appeals of the priests and poetical associations of places and scenery, and even the powerful considerations of *fungshui,* appear to be on the wane and to be giving place to more utilitarian views; for in many spots where monastic influence has for centuries preserved larger or smaller tracts of forest land from denudation of their trees, ruinous temples stand with but a few isolated trees near, sparse mementoes of the luxuriant groves in which the buildings originally reposed in the depths of magnificent forests. This destruction of trees during the last twenty years has been doubtless accelerated by the rebels who have overrun most of the country at various times. Their war-cry in Kwangtung was, "Destruction to the temples!" and though many have been rebuilt or patched up, the trees cannot be rebuilt like the houses, and many years would be required for them to acquire their former status as forests—if, indeed, the greater difficulty of protecting the young trees and the loss of the sentimental ideas which formed the chief protection of the old ones will at all allow of their re-growth. Wherever the rebels encamped forests, small in extent but the

growth of centuries, where they existed, were ruthlessly destroyed to afford fuel and timber to the marauders, and where they escaped the lost character of sacred groves and the deteriorated influence of monks now allow the sound of the axe to resound through the otherwise still and sombre forests. Thus in 1854 tall fir-trees on the White Cloud Hills near Canton were destroyed, and in the celebrated Lofau mountains many were cut." Other writers corroborate this account of the havoc spread by the Taiping rebels, who are said in Chekiang province to have destroyed the woods in sheer wantonness, so that the only wooded hillsides left were those where their ravages did not extend. And in the neighbouring province of Anhui the Abbé Havret refers to their ravages, which were followed by the incursions of new settlers from Hupeh, who threw themselves upon what remained of the secular forests in the regions near the Yangtze, and wiped them out of existence. It is true that the enormous destruction of human life by the Taipings and Imperialists during the great rebellion operated to some extent as a check on deforestation by depriving whole districts of their

inhabitants and returning them to a state of nature, but these areas were soon filled up by new settlers, who knew and cared little for the sacred character of the groves, and ere long completed the work of devastation on the hill-sides.

In the densely populated regions of the Great Plain this destruction of forests bears fruit in the train of calamities due to flood or drought, consequent on the removal of Nature's covering of the earth; and in the loess provinces of the north a progressive desiccation and the encroaching of the sands from the desert are discernible. The whole subject has been summarized in a review by Mr. Purdom, a botanist who has travelled extensively in China. Mr. Purdom, after pointing out the serious effect of the loss of forests on the climatic conditions of the country, says: "The effect on the general contour of the land from erosion, the depredations made by extension of river-beds from silting, and the exposure of crops to full climatic conditions should engage the serious attention of those interested in the welfare of the agricultural population. Fuel is notably

scarce in China, but even this does not excuse the wholesale scraping from mountain-sides of every particle of vegetation, a matter of compulsory daily occurrence in many provinces, which results in the extinction of all soil-binding plants, to say nothing of the many fine species of trees and shrubs thus lost to the world. This havoc is particularly galling when one thinks of the effect the development of the country's immense coal-fields would have on this question of fuel. . . . Then the lack of timber will seriously affect the development of the country in such matters as extension of railways, development of mines, and the building of bridges, both from the point of view of cost and facility of carrying out these enterprises. Many small local industries must in time suffer from want of material, though this aspect of the matter is comparatively unimportant." Mr. Purdom proceeds to make very valuable suggestions for afforestation and dealing with erosion and desiccation generally, but this matter will be returned to in the proper place.

To suppose that the Chinese have worked this dire destruction because they are lacking in

appreciation of natural beauty is one of those fallacies which are current among the nations of the West. This particular fallacy has been exposed by a recent traveller, the Vicomte D'Ollone, in spirited fashion. "Who is it," he asks,[1] "who says the Chinese detest trees? On the contrary, no people loves them more: every house has one or several in its courtyard or garden, so that you may expect a village in the district when you see a wood, and the pagodas, which are the only places of public assembly, all possess groves which are usually ancient. In short, you see trees everywhere in the neighbourhood of houses—a sufficient proof that they are not unpleasing. Why, then, does the Chinese, who loves to have trees about his house, so pitilessly destroy those at a distance, thus grievously denuding the mountains? Because wood, the only material used in building, is very expensive, and when it belongs to no one it is naturally taken. All the great mountain ranges are no-man's lands; every one took what he could for fear lest his neighbour should be before him." It must be borne in

[1] *In Forbidden China.*

mind that the Vicomte is writing of the province of Szechwan, which has been specially favoured by escaping the attacks of rebels, and that in North China the houses are not built of wood, for lack of that material; but he is right in attributing the love of trees round farmsteads as a characteristic of the Chinese, for the actual fact is of universal occurrence.

PART I

THE FOREST PROBLEM IN CHINA

SECTION I

PHYSICAL AND CLIMATIC CONDITIONS

A SUMMARY of the physical and climatic conditions of China is essential to the study of the forest problem. Ethnographically, the country may be roughly divided into the twenty-one provinces of China Proper [1] (which, however, includes many highlands, where aborigines live in complete or partial subjection) [2] and the Outer Dominions. This division conforms to the limits imposed by the natural configuration of the land —the race of Han having through the course of millennial periods gradually occupied the low-lying lands of East Asia, but not having entirely reduced the vast territories on the borders of

[1] Including Manchuria, which the Chinese name the Three Eastern Provinces.

[2] Note, however, that in S.W. Yunnan the Chinese have failed to establish themselves in the fever-stricken lowlands.

these lands. The line of division between these two areas is shown by the broken line in the map. The territory north and west of this line forms part of the great Central Asian plateau and includes Tibet and the Sino-Tibetan Borderland, a region of lofty ranges and Alpine pastures; the depression of Chinese Turkestan and the Gobi, running north-east to N. Manchuria; and, beyond, the border ranges of the Tien-shan, the Altai, and the Syansk, dividing Chinese territory from the plains of Siberia.

The vast ranges of the plateaux throw out offshoots eastwards into China itself: the border-ranges south of the Gobi—the Ala and In-shan—are continued in the Khingan to the Upper Amur; the Kuenlun is projected due east from the Kokonor in the Tsingling range, which persists in the low hills of Honan and Hupeh, while the Tapashan constitutes another ridge running east to the Great Plain; finally the mighty Himalayas themselves take a southward direction and run in a gridiron formation of parallel ranges down to the tropics, and thence eastwards from the Yunnan-Kweichow tableland in a sea of con-

fused hills to the coastline of the China Sea. Thus China proper appears as a region tilted in a gradual slope from the interior plateaux to the coast, drained by two great rivers in the north and centre, and by lesser streams in the complicated mountain system of the southern provinces.

The total area of the Chinese dominions is estimated at nearly 4,300,000 sq. miles, of which China proper comprises somewhat under 36 per cent., or 1,532,000 sq. miles. If Manchuria, with 363,000 sq. miles, is added to this total, the sum represents the whole area east of the border ranges of the Central Asian plateau, and the figure—1,895,000 sq. miles—gives 45 per cent. of the whole area of China. Thus China is divided into two almost equal areas, distinct in flora and fauna and even ethnographically. The question of the population of China is a vexed one, and remains for the future to decide. Figures so diverse as those of Supan [1] —291½ million—and Keltie [2]—427 million—have been estimated in recent years. The latter figure

[1] *Bevölkerung der Erde*, No. 135, p. 46.

[2] *The Statesman's Year-Book.*

has been accepted by the China Inland Mission in their publication *The Chinese Empire*, but the truth probably lies somewhere between the two figures. However, the facts remain (1) that the Great Plain, the West River delta, and part of Szechwan are among the most densely populated regions of the earth; (2) that the north-westerly area of China (Tibet, Mongolia, and Turkestan) is very sparsely inhabited.

A glance at the map at the end of this volume shows unmistakably this, the most striking difference between the two areas of China. The cause of such disparity is, of course, the physical configuration of the land, as described on the preceding pages—the vast tracts of desert, remains of primeval seas, and inhospitable snow-clad plateaux on the one hand, with the fertile, well-watered regions of the south-west on the other. The climate of China has not yet been studied—observations extend over a limited number of years and have been made at comparatively few places, especially inland. Subject to these limitations, however, the following remarks may claim general accuracy: The remoter parts of the exterior dependencies possess a "conti-

nental " climate—that is to say, great extremes of heat and cold, both as between summer and winter (there are practically no intermediate seasons) and on single days; they are also characterized by extreme dryness, amounting, according to many authorities, to progressive desiccation;[1] they are almost cut off from external supplies of moisture by high ranges, which receive the rains from the south and north alike; they may, indeed, be said to be almost self-contained, and their few rivers, derived from glaciers, are only made use of by careful irrigation systems, and finally lose themselves in the deserts.

But eastwards from the Central Asian plateau the country gradually comes increasingly under the influence of the monsoon winds; whereas Western Tibet is a land nearly devoid of moisture, the eastern portion of the plateau, as far as the Kokonor district, receives rainfall from the monsoon from the Bay of Bengal; next, the eastern border of Mongolia, from the Alashan

[1] This statement may, however, require modification; vide the interesting paper by Professor Gregory, Part II. *Geog. Journal*, March 1914.

northwards, receives a heavy rainfall in the summer. This monsoon influence differentiates East Asia from West Asia and W. Turkestan, where rain falls only in the winter. An attempt has been made in the map to show the extreme range of the monsoon rains from the south. In China proper, W. Szechwan and S.W. Kansu receive a very heavy rainfall from June to September; the air is, indeed, so saturated in the mountains that Abbé David has left on record that were a man to fire a gun it would bring down a heavy shower. Hence the luxuriant vegetation of these districts, where palms and bamboos grow to a considerable altitude. These abundant rains are brought by the south-east winds from the China Sea; the extreme west of Szechwan and N.W. Yunnan—or the Tibetan Marches—are shut off by gigantic massifs from the south-west monsoon winds from the Bay of Bengal: they are, therefore, comparatively arid and timberless. These massifs—the ranges running south from the Himalayan system—decrease in altitude as the tropics are approached, and their disposition from north to south in S. Yunnan permits the ingress of

the monsoon rains there. The prevailing wind in the rainy season (June to September) is westerly. Here are found tropical forests—the continuation of those of Burma and Siam—in the valleys, and temperate forests, beginning already in N. Siam and the Laos, flourish on the mountain sides.

The region of the Nanshan, or the Yangtze divide stretching from Kwangsi to the Great Plain, is affected by the monsoon from the China Sea. Here the rains, having freer access to the land, begin earlier, and the rainfall is both heavier and spread over a longer period—i.e. from April to October, and even in the cold season rainfalls occur. Being near the tropics and protected to a considerable extent from the northerly winds of winter by the low ranges of the Nanshan, this region enjoys a luxuriant vegetation, and few of the cereals or trees peculiar to sub-tropical and temperate climates are wanting in this favoured region. While the former are cultivated to the utmost possible extent, the forests are unhappily devastated, but with reasonable protection should be capable of yielding timber supplies in abundance and of preserving the hillsides.

From South China, with its heavy rainfall and high average temperatures, with almost complete absence of frost, there is a gradual transition to the Central, or Yangtze basin-zone. Thus Hunan and Kiangsi have considerably lower winter temperatures than the provinces south of the Nanshan (so that, e.g., bananas do not ripen), the flora becomes less and less tropical, and when the Yangtze itself is reached, winters in which the temperature always falls below freezing-point are the rule. However, where the Yangtze is confined by mountains before reaching the Great Plain, its basin, protected thereby from the cold winds of the north, enjoys a milder winter than the coast provinces near its mouth. The plateau of Central Yunnan, on the extreme south-west of this region, has a most equable climate, with no extremes of temperature, and serene skies, and is likely at some future date to become " the Switzerland of China " and a great fruit-growing country. The name Yunnan, or " South of the Clouds," indicates that the neighbouring province to the north—Szechwan—has a different climate ; here the dampness extends to the winter, in which season banks of mist

hang over the province, sunshine is rare, but the temperature rarely falls below 35° Fahr. Over this area and the easterly adjacent regions the south-east monsoon sweeps in summer, bringing heavy rains, which begin on the Lower Yangtze in April and attain their maximum about July. The monsoon continues over Hupeh into Kansu, in which province, where it reaches its limit, the rains do not, however, begin until late summer.

From the central belt, with its transitional climate, to the northern region, the change is again gradual; it is marked by an increase in the range of temperature, with growing daily variation owing to the now excessive radiation due to the dryness of the air, by less rainfall (under 1,000 mm.), which is, moreover, concentrated in the summer half of the year, when not less than 70 per cent. of the moisture-deposit occurs. In Honan, which is several hundred miles from the coast, often no rain falls for six or eight months; there is no longer any "wet season," though heavy falls occur in June and July. In Shantung and Shansi also periods of protracted drought are quite normal, and all these provinces are char-

acterized by the absence of tree cover. Indeed, it seems possible that this Yellow River region is only saved from becoming a desert by the fact that much of the soil is loess, which has the property of conserving the rainfall in its peculiar structure. As it is, the sufferings caused by the floods of "China's Sorrow" are almost without parallel, and no one can tell how far they have retarded the progress of the country.

Note.—In connection with this subject the following observations from a British Consular Report may be considered worth reproducing: "In 1877 a constant aerial current of great depth between the belt of 30–31° N. Lat. flowed from west to east along the line of the Yangtze, barring the passage of the monsoon, and causing floods below 30° and drought in the north, which, having no great lakes, derives its rain supply mostly from the moisture brought from the tropics. In July 1879 the current disappeared," but millions of deaths had been caused by the famine of these years.

In the extreme north of China proper the climate verges on the Siberian or continental, and the characteristic dust-storms are a feature of the winter, being brought from the desert by the prevailing north-westerly winds. In a large part of Manchuria—the last limits of Chinese territory—the climate is favourably modified by

the presence of forests; but as these are being cut down, unfavourable conditions are beginning to manifest themselves, and it is of prime importance that these forests should be protected, not only for the sake of the timber supply, but also on account of their value in influencing the climate by preventing evaporation of moisture, by preserving the flow of rivers, providing shelter belts, and in other ways.

SECTION II

GENERAL DESCRIPTION OF FORESTS

ANHUI

THE northern portion of Anhui—the Huai basin —lies in the Great Plain; the central prefectures, north of the Yangtze, though hilly in parts, have long since been denuded of forests, and it is only in those prefectures south of the great river that forests are still found. The mountains which traverse this region in a south-west to north-east direction are the last outliers of the Nanshan system. Richthofen shows that the general character in S. Anhui is determined by the division into three great belts (geologically): the geographical subdivision of these into very numerous small ridges which partake in the trend of the main range; the gradual setting in, between these ridges, of branches of the Yangtze plain, which increase in extent as we

recede from the southern boundary of the province and approach the Yangtze; the intervening between these plains and the hills of a barren terrace. The central portion of S. Anhui, where the mountains rise to over 6,000 feet, has been little explored, and is heavily timbered, the Makin ling and Langshan, on the Chêkiang border, to a lesser extent. The forests are mainly coniferous, consisting of pine, *Cunninghamia*, and cypress, with some oak and liquidambar, and much bamboo.[1] In Huichow prefecture the wood goes south to the Poyang Lake, by the Rivers Chang and Wu, though now in small quantities; but chiefly to Hangchow by the Singan kiang, an affluent of the Tsientang. Much firewood is floated down from Kimên for use in the furnaces of the great porcelain district of Kingtê, in Kiangsi. The camphor-tree grows to a great size in this region, and fine elms are also found, with some wood-oil-trees. Colonel Wingate, who visited these hills, says that afforestation seems to have really taken root

[1] The "golden larch" seen in these forests by Mr. Lyall of the Customs is probably Abies kaempferi described by Fortune in Chêkiang.

there, the trees having got a start after the Taiping rebellion, when there were none left to cut, and Richthofen witnessed the process when crossing the Langshan.

But in Ningkuo prefecture, to the north-east, settlers from Hupeh, to whom the depopulated land was thrown open, denuded the hills, and it is only in the extreme corner of the province that woods still exist. Abbé Havret, in his work on Anhui, describes the establishment of a colony of Fukienese here, who, coming from a province where timber was of paramount importance, preserved and planted woods, so that the hills west of the Tai Hu (Lake) are still well wooded with pine, cypress, camphor, tallow, and arbor vitae.

The hills facing the Yangtze in S. Anhui are now very bare; the streams run down in freshets to swell the Yangtze and assist in causing the disastrous floods which so frequently devastate the plains, or are choked with sand and rendered unnavigable during the dry season. Only at Kientê, where the south-west end of the province adjoins Kiangsi, are the hills still to some extent wooded, where distance from streams and difficulty of transport have saved the woods

from the axe. Here the trees are small firs, scrub oak, tallow, and bamboo, besides the liquidambar, used for tea-chests in the neighbouring districts of Wuyuan and Kimên, famed for their tea. These woods contain many wild boar, panthers, and deer, whose horns are an important article of commerce in the drug trade.

North of the Yangtze Anhui has but little wood; the Huai basin is almost treeless, and notorious for its floods; the houses are built entirely of mud, and practically no furniture is used. In Liu-an department, on the borders of Hupeh, the hills were once splendidly wooded, but the forests have now been supplanted by plantations of small pine, on whose roots the fungus fulin (*Pachyma cocos*) is produced. Persimmon orchards in Huoshan form a pleasant relief in the general treelessness. Many specimens of trees have been collected in these hills by Père Heude, including corylus, alder, poplar, lime, chestnut, kadzura, etc., and these trees would doubtless flourish again if afforestation were taken in hand. Only a generation ago a traveller reported that the hills were well wooded southwards from Shucheng, in the centre

of the province, so that wholesale destruction is of recent date in these parts.

It is in the wooded hills of the south that the prospect for afforestation is hopeful, and its importance lies in the circumstance of the proximity of great markets, such as Hangchow, on the Tsientang, and Wuhu, on the Yangtze, which supply timber to a very large area in the plains. At the latter port one of the wealthiest and most influential interests is the timber trade. The foreshore for two miles below the town is occupied by rafts and woodyards, which employ thousands of labourers. Here the great Yangtze rafts are broken up and formed into smaller units to be sent up the creeks in various directions. In view of the extreme difference in price between the raw trunk and the sawn plank, stream saw-mills should do well here.

Liquidambar and pterocarya trees are found in all parts of Anhui; a more valuable wood is that of Torreya nucifera, of which small woods exist in Ningkuofu, between Shuitung and Kwangte. Some Lindera triloba is also found.

Photo by] [*Mr. Mencarini.*

ENTRANCE TO TIEN DONG MONASTERY, NEAR NINGPO, WHERE FORTUNE BOTANISED.

(From "In the Land of the Blue Gown," by Mrs. Archibald Little.)

CHÊKIANG.

The great plain of China comes to an end in N.E. Chêkiang, where, in the great silk district, one of the wealthiest parts of the country is found. But by far the larger portion of the province is mountainous, for the Nanshan range sends its last spurs through the west and south —a region of lofty mountains branching out by degrees into a very varied and charming hill country, which will doubtless some day be as well known to the tourist as the Japanese hills.

The axial range, which runs through the centre, divides Chêkiang into the basins of the Tsientang, in the north, and that of the Wu and other smaller streams, on the south. The Wu basin, together with the headwaters of the Ku, an affluent of the Tsientang, is the chief timber district of the province. Before the Taiping rebellion the eastern prefecture of Taichow, near Ningpo, was bountifully timbered. The naturalist Fortune describes his journeys into this charming hill country, with its wealth of oak, chestnut, and other deciduous forest, with pine, fir, and graceful cryptomeria. But after he wrote

the rebels devastated the woods in sheer wantonness, and the only wooded hillsides left were those where their ravages did not extend. It is true that the tea-plant has now taken the place to some extent of the old timber, but doubtless there is room for much replanting.

Ch'uchowfu, the seat of the present industry, is described by Duhalde as a region of vast mountains, covered with handsome trees, and among others with pines of such an extraordinary size that some will hold thirty men in the cavity of the trunk. Five large streams contribute to form the River Wu, on which Ch'uchow stands, and whose mouth is at the treaty port of Wenchow. Of these the Tasi-ho is now the most important timber-carrier, and the town of Lungchuan, on its banks, the chief depot.

This district sends down to Wenchow yearly some 1,700 rafts, containing 440 logs each, besides 1,000 rafts of bamboo, and 30 per cent. more than this amount of timber is said to go by the other river to Hangchow. From Sung-yang and Kingning districts also the market at Wenchow is supplied. Most of the timber cut is fir, but there is also some pine, cypress, and

juniper, and probably cryptomeria. The deciduous trees include camphor, which is rated the highest, and used for knees in junkbuilding; elm, poplar, and some good hardwoods, such as dalbergia, the latter being now found only at the headwaters. Tea-oil is abundant in the Ch'uchow district, where the coir-palm is also prominent; tallow-trees grow abundantly throughout the lower hills of the whole province, and bamboos are largely exported. The subsidiary products of this district include nutgalls and china-root, and a certain number of skins, chiefly land-otter, fox, raccoon, and badger, with a few tiger.

Unfortunately, nearly all the large timber in these hills has been cut—there are now no signs of the vast trees mentioned by Duhalde. The average length brought down now is not more than 25 feet, whereas prices have advanced enormously, and even firewood, of which a great deal is exported, has increased in a few years from Tl.0.50 to Tl.0.90 per picul. Although the high figure of $5\frac{1}{2}$ million sq. feet of softwood planks were sent to Shanghai from Wenchow in 1908, there has since then been

felt a tendency for these to be replaced by the cheaper and better Foochow article, and in 1910 Wenchow planks were a glut on the Shanghai market, without quotations or sale, and the result was that many local plank firms closed their doors and suspended business. As, however, these planks are suitable for cases in the kerosene oil industry, and owing, too, to the decline in exports from Foochow, this state of affairs is not likely to continue. It is of vital importance that the denuded hills should be replanted, and, from a Chinese report, it seems that this necessity is at last being understood by some of the local merchants, who might perhaps also welcome the opening of a saw-mill. There are losses incurred also in the rapids descending the river which might be obviated; taxation also is considered heavy on the trade. The terrible devastation and loss of life by the great flood in 1912 is at least in part traceable to the denudation of the hills, and disasters of this kind are certain to recur if the hills are not replanted.

The central range of Chêkiang—the Tapên shan—is still well wooded in parts, and down the Mei and Wu Rivers long, narrow pine-rafts,

so made that they can be divided and moored at any point, are transported to the Tsientang. This river is well wooded from Fuyang, near Hangchow, up to Yenchow, and the scenery is very beautiful ; but very little timber is cut here. Lanchi, on the Ku, is an important timber market, but the hills near have long since been stripped. Tallow, wild camellia, and bamboo are the chief trees. On the upper waters of this affluent of the Tsientang the forest is continuous into Fukien, but there is no great cutting going on. Some timber is still cut in the Suian district, from the Makin ling, on the Anhui border ; and the Langshan, which form the boundary farther north-east, are thickly wooded with fir and mountain bamboo growing together. These hills, the last spurs of the Nanshan, formerly supplied much timber to Hangchow and Huchow, and large supplies of firewood are still sent to these centres. The tallow plantations are one of the features of the whole Tsientang valley, and many fine camphor-trees, cypress, and arbor vitae still exist there.

CHIHLI.

The metropolitan province covers a large area in North China, and varies considerably in character. The great plain of China extends over the south and centre, whereas in the north-east and a large portion of the west are rugged hills, formerly forest-clad. The flora of the plains corresponds in a great measure with that of the level districts of Shantung, and especially in central Chihli, as each village has round it a certain number of trees, and the rest of the plain is treeless, the effect to any one in the centre, by the grouping of the villages, is that of an unbroken forest. These trees comprise orchards of apple, "date," pear, peach, "pepper," persimmon, etc., with plantations of poplar and willow, and of the great white pine, which is almost confined to N. Chihli. Cypresses and cedars adorn the numerous tombs and graveyards, and in some places the roads are lined with splendid trees, proofs of the taste and munificence of Kanghi and Kienlung, the great emperors, by whom these park-like expanses were laid out. Farther southwards the country

becomes more bare, but plantations of birch, poplar, and willow are maintained for the supply of fuel, matchwood, and scaffolding poles.

Along the coast-line of the province, where sandy or marshy tracts exist, tree life is rarer, but nearing Manchuria elms, poplars, and willows thrive in valleys along streams, with the pine in more exposed situations, and ailanthus, cedrela, catalpa, sophora, etc., are also found. The Chinese Engineering and Mining Company has established vast plantations, chiefly of acacias, at Tangshan, and at the mouth of the Tang-ho white poplars have been planted. The acacia is a foreign tree which has done well in N. China. Walnut-trees, where they exist, are valued for making furniture.

In the region beyond the great wall north of Yungping prefecture, the barrenness of the southern slope of the hills gives place to thick woods, at first of pines and oaks, and later of poplars also. In one locality the hills are named Polo Hills, from the oak of that name, which is grown upon them for the cultivation of wild silkworms. But this wooded condition is the exception; in the north-west and west there is

an endless succession of bare ranges. The sole remaining forest is the old Weichang, the hunting forest of the emperors. Of this primeval forest Colonel Wingate says:[1] "It shows what must have been the appearance of all N. China beyond the limits of the great plain. But the Chinese have left scarcely a tree on the hills, so probably altering the rainfall, which now descends in heavy bursts, flowing quickly down the bare slopes, carrying much soil and causing floods and devastation in the plain. The forest is now (1910) only 400 sq. miles in extent. Silver birch, pine, larch, willow, cypress, walnut, holm oak, compose the forest, with a jungle of thorny undergrowth and long yellow grass. The holly-tree is common." The "great forest" is now only a hundred square miles, but there are other tracts well wooded near by. However, since the revolution the inroads on the woods have largely increased, and the whole area will be denuded before long unless steps are taken to preserve it. One other wooded region exists in N. Chihli—the Hsiling or Western tombs of the Emperors. Here is a beautiful glen, wooded with birch, oak, and other forest trees, a spot of verdure among the barren hills.

[1] *Geog. Journal*, vol. xxix.

REMAINS OF LARCH FOREST, WEICHANG.

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FUKIEN.

Fukien is an almost unbroken stretch of hills and mountains, drained by streams which are swift and rocky except near the coast, where are the only plains, of small extent. The province has been for a long period the chief source of timber supply for the northern provinces, and at one time it was believed that its resources were inexhaustible, but the inroads of the cutters have been so great that the supplies are even now becoming short; large logs are now very difficult to obtain, and prices have advanced enormously.

The Fukien flora is of an intermediate character between those of the northern and southern provinces—the tropical species of the south being found in the lowlands and the species of the more northerly latitudes inhabiting the mountains from two to three thousand feet up. The hills along the coast from Amoy to Foochow are mostly very bare, resembling those of Kwangtung, but inland the soil is richer, and a great variety of trees is found. The province may be divided into three portions :—

1. The north-eastern, Funing prefecture, and the hinterland of Santuao. The mountains on the confines of Chekiang are but little known. Drained by a number of short rivers, they are very wild and, in their less accessible parts, still well-wooded, but the available timber has been ruthlessly exploited; indeed, there are no camphor-trees left in this district. On the other hand, "some pains have been taken to impress on the natives the advisability of saving their hazel-trees instead of cutting them for fuel, and tea-oil is being produced in increasing quantities" (Santuao Customs Decennial Report, 1912). Missionaries who have visited these districts north and north-east of Foochow describe them as being of beautiful and diversified scenery —some parts bringing to memory the English Lake District, others consisting of wild moorland, while in river valleys there are forests of bamboos, with a grace all their own.

2. The second region of Fukien is the basin of the Min. From the headwaters of this river the chief supplies of timber exported from the province are still derived. Timber shares with tea in creating the wealth of Kienning prefec-

ture, but both industries are waning, and from similar causes, viz. the ignorance and lack of foresight of the producers and the greed of the middleman. Nor have any measures been taken by the Government to enforce replanting (on this subject vide under Camphor). As long ago as 1846 Parkes obtained statistics of the value of the timber trade, and the contrast between then and now is very striking. The exportation figures alone in 1846 were £2,000,000, while in 1906 the value of the whole trade at Foochow was only £300,000. In the Shaowu district, where the hills were formerly covered with trees and bushes, the soil has now been washed away, leaving bare and unproductive rock, down which the rains rush in flood. In the south-east of Shaowu fu, however, bamboo woods still flourish, and provide material for the paper industry. In fact, bamboos form a large proportion of the woods in Fukien; for the rest, the forests are mixed, their chief constituent being the cunninghamia fir, while other conifers are the cryptomeria, yew, cephalotaxus, and a silver fir, and among deciduous trees are the oak, chestnut, camphor, tallow, with a few of a species similar

to nan-mu and dalbergia. The Pucheng region is, being comparatively inaccessible, still well wooded; in fact, there is continuous forest, with scenery of unrivalled beauty, from Pucheng to Chuchowfu in Chekiang. The same applies to the country westwards from Pucheng to Chungan, the centre of the Bohea tea district, but from this place down-stream to Kienning, though the hills are prettily wooded, there is no more timber of any size. Among other forest products of this region are tea-oil, wood-oil, paper and bamboo-shoots, lotus-nuts, and resin; the camphor has been exploited out of existence by the Japanese. Very much of the wood sent down the Min is said to be lost *en route,* but a system of insurance has now been inaugurated which, it is to be hoped, is a sign that more business-like methods are to come into vogue.

3. The third region of Fukien is the southern half of the province, whose rivers mostly drain southwards to the coast, and not into the Min. This region is one of the least developed parts of China, and is little known to foreigners. It is a broken and mountainous country, whose highest peaks rise to 8,000 feet, sparsely popu-

lated and densely forested in parts, especially on the Kiangsi frontier. Mr. Clennell, of the British Consular Service, travelled in 1892 on the Yungfu River "through an immense forest of pines, bamboos, larches, and especially firs, interspersed with many other varieties, over an endless succession of hills and dales and forest-clad ranges, with an impenetrable undergrowth of ferns, grasses, and bushes ten feet high. The coir-palm is a native here, being found in the clearings, and camphor, tallow, elms, and banyans also." [1]

The coast region receives its wood supplies from these forests, being itself bare of timber trees, though fine orchards of lichee, lungan, orange, pumelo, etc., make this coast-line famous for its fruit. At the headwaters of the Kiulung River, which debouches near Amoy, there are high mountains covered with woods. Mr. Bowra, of the Customs, gives the height of the Mashan peak here as 9,000 feet. But these regions are also being denuded. Since Messrs. Bowra and Clennell wrote of their travels—a period of over twenty years—the axe has been busy, and Dr. Maxwell, a missionary resident in

[1] Parliamentary Paper, 1892.

this district, now says "there is nothing which might properly be called forest in South Fukien so far as I know—there is only wooded land." However, in the more remote parts, where transport is difficult, there are still probably forests, and towards the west, in the Tingchow prefecture, large forests still exist, especially on the Tachin Range along the Kiangsi border. These forests are composed of pine, fir, cedar, varnish, liquidambar, camphor, and other trees. Some of the wood goes down the Han River to Swatow in Kwangtung, but the middle course of that river (in Fukien) was cleared of wood a generation ago. Even at Tingchow it is seldom that a trunk so large as three feet in diameter is seen now. The best hardwood in S. Fukien as, in Kwangtung, has been destroyed.

HONAN.

Honan, a typical province of the Great Plain, is perhaps the most treeless region of China, and the dwelling-houses are built almost entirely of mud or brick, or in some localities of freestone, while kaoliang stalks take the place of bamboo in fencing, thatching, and other uses. Bamboo

A TIMBER-LADEN JUNK.

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does indeed exist, though not as an indigenous plant, in the rich valley of Huaiking, where there are important plantations, but not elsewhere. This region—the garden of the province—produces splendid orchards of peach, apricot, plum, etc., and the dates of N. Honan are famous, and the hills of the west grow oaks, on which wild silkworms are raised. But of timber-trees there are none growing in woods, though in Duhalde's time the western hills were covered with forests. Probably these regions of the Funiu Mountains, the last offshoots of the Kuen Lun system, now so barren, might be replanted. Among the trees of the plain, willow and poplar are the most common, with the ordinary Pinus sinensis.

HUNAN.

The province of Hunan has been from ancient times one of the chief sources of the timber supply of China, and large areas are still under forest. These districts are in the south and west of the province, and are drained by three rivers—the Yüan, the Tzu, and the Siang—down which the timber is conveyed to the Tungting Lake,

and thence, after satisfying the local requirements for junk and house building, to the great marts on the Yangtze. The areas are here treated in the order of the rivers above named:—

I. The Yüan possesses many large affluents, and the mart of Shênchow (vide map) is situated at the point where the river receives the last considerable accession to its volume.

1. The Pei or North River. This stream has its sources partly in Kweichow and partly in the wild region where the three provinces Kweichow, Hupeh, and Hunan meet, in the Pamien Mountains. The North River is credited with one-third of the total production of the Yüan basin, for its whole area is forested. The chief woods sent down are cunninghamia and pine, the best specimens of which come from the north-east corner of Kweichow. Cypress is also cut. The conifers do not as a rule grow in mixed forests with deciduous trees, of which the principal ones from this region are cedrela, some camphor and nan-mu, which, though found in the whole of the Pei basin, is said not to grow elsewhere in Hunan. Some very large logs of this wood are still floated down to Shênchow

from here. Some oak is also found, but of small size, the larger specimens having all been cut and replanting not undertaken. In the corner of Hupeh drained by the Pei the wooded area is too far from streams of any size to be available for cutting except for the supply of firewood, and this applies also to part of Kweichow.

2. In the central portion of its course—i.e. from Shênchow to Hungkiang—the Yüan receives but little wood from its right bank, while the supplies from the affluents on its left—and, indeed, in the whole of the rest of the course of the main river—are now sadly shrunken as compared with those obtained a generation ago. On the left bank some supplies are still received from Fênghuang and the Kweichow border. But the main sources of supply for what is called by the Hunanese the West Lake timber are the affluents on the right bank above the mart of Hungkiang. These regions are—

3. Tsingchow; and (4) Liping (in Kweichow, which vide). Both derive their timber largely from mountains occupied by Miao and other aborigines. This timber is mostly coniferous (90 per cent.), pine and cunninghamia, partly

perhaps because conifers, growing more rapidly than deciduous trees, yield quicker returns on investments. The best cunninghamia is produced at Huitung, while that from the Miao land is inferior. Other trees produced are said to include oak, camphor, dalbergia, etc. (vide list on p. 65). The trade in this timber is attended with trouble and danger, and, as a period of two or even more years is needed for a merchant to go from Hankow to the hills and return with the timber, high profits are the rule; a tree which costs some 30 to 50 cash originally may realize $1 at Hankow. The following account of this trade appeared in the Yochow Customs Decennial Report, 1902: "The timber trade is a monopoly in the hands of three guilds from different provinces. The charge of unfair dealings with the savages is said to have been well founded in Hunan, and to have been the cause of numerous revolts in these parts. It has therefore been found advisable to restrict the trade to these guilds, which are directly responsible to the authorities for the fulfilment of their contracts with the natives. The guilds send their own men into the hills to fell and trim the trees

preparatory to floating them down to the nearest marts. The trees are cut in the autumn and winter, by the *fu-shou*, or axemen, who receive 300 cash per day; they only cut the trees half through, leaving them standing till the first gale comes along, when, with one sweep, whole forests will come down. It is said they replant trees, so as to prevent the supply from being exhausted. The choppers, or bill-hands, next strip off the branches and bark, receiving 240 cash daily; and finally the auger-hands make a hole in the butt of each tree, to facilitate the work of building the rafts, receiving a remuneration of 5 cash per tree. The timber is floated down the mountain streams, with the spring and summer freshets, to the nearest places where the depth of the rivers admits of their being made into rafts, the size of these being increased at the principal timber marts."

The forests of the Yüan basin abound in other products besides timber, such as varnish, wood-oil, nutgalls, skins, wax, etc. On the lower reaches of the Yüan the coir-palm flourishes.

II. The Tzu River is of very much less importance than the Yüan. Its area was estimated

by Richthofen at 19,000 sq. miles, as compared with the 34,300 of the Yüan, and the Tzu is, besides, so rocky that 20 per cent. of the junks which descend it are said to be wrecked. It is only near the headwaters that timber is produced, and there are two areas—

1. The Wukang region. Here there is hardly any timber but coniferous, and the "fir" (cunninghamia) is found from the valleys to the brushwood limit.

2. The other district is on the Lo River, and it is stated that the only area here which can really be called "forest" is that between Chênpu and Sinning, a very wild bit of mountainous country on the border of the aboriginal country, and the high ground of a watershed. Here considerable felling is carried on, mostly of "fir." In both these areas the undergrowth is thick and tropical-like, and affords cover for much big game—tiger, leopard, etc.—and the entrepôt of Paoking, situated where the river has attained more volume, is a large market for skins, while some resin is also sent out from this town, near which also are many well-cared-for plantations of small pine. The

great mart on the Tzu is Iyang, situated near its mouth. In addition to its timber trade, Iyang is the centre of the bamboo industry of Hunan. From Iyang to Paoking the river banks and the adjacent country are covered with bamboo-groves, and the industry is valued at over one million taels, the bamboo ware of Iyang being famous. Much paper is manufactured there also.

III. The third timber district of Hunan—that of the Siang River—differs in character from the other regions. The Siang basin has an area of 39,000 sq. miles, but it is only in its upper reaches that timber exists. Of this district the railway engineer W. B. Parsons says: [1] "In the past the rough hillsides of South Hunan furnished great quantities of timber, and though the large trees have long since been cut, extensive rafts of small second-growth timber are frequent sights on the Siang. The natives are beginning to recognize the value of growing timber, and tree farms on an extensive scale are seen in several places. The pine, probably on account of its rapid growth, is in each case selected as the tree to be raised. That arboriculture has proved itself to be a successful

[1] *Geog. Journal*, vol. xix.

venture is indicated by the quite general setting-out of young plants. So much of Hunan is unsuited for farming, but is adapted for forestry, that it is safe to predict that the thrifty Chinese will, when they are convinced of the financial return, devote a very large proportion of the province to tree farms." The area where this system of tree farms is in vogue is that drained by the Rivers Tao, I, and the headwaters of the Chun, tributaries of the Siang, south of the important city of Yungchow, and covering perhaps some 2,500 sq. miles. To the casual traveller on the main routes in this district it is a problem whence the very large supplies of timber which are rafted down the river are derived, for no forests are to be seen near the large roads. It is for the most part in localities at some little distance from the main roads that the timber is produced, in carefully worked areas of mountain, not severally extensive, that systematic planting is engaged in. These hillsides are conserved by well-managed clan estates. There is only one such area below Yungchow, but above the city the district begins not many miles to the east, where there are dense pine-

woods. But on the whole the practice of cutting the trees at short intervals—eight years on an average—gives a very poor first impression of forest. Also the cutting is so divided into small holdings that there is very seldom any wide stretch of country hidden under foliage.

Forestry, then, is an occupation thoroughly well understood in this region, at least on a small scale. Some of the plantations are wonderful sights, lane after lane fading away in perspective between the perfectly planted rows of tree-stems. Apart from the mountain slopes, the afforestation of the hills is excellent in this upper Siang valley. Fir and pine are the only trees commonly planted; camphor is much less common here than usually in Hunan; a large-leaved oak is often seen. But the feature of the region is in Kweiyang sub-district, where the cypress has been planted and allowed to attain a large size (e.g. 9 ft. 6 in. in girth). This tree exists also farther north, but is there poor, clipped, and stunted.

As regards the region south-west and west of Hêngchow, it would be absurd to speak of forest areas where man has lived and worked

for centuries ; but, apart from trade supply, trees seem to grow everywhere, and the fuel demand is not so acute as to have utterly denuded the land. Consequently, scattered trees are so common that, e.g., the main Yangtze valley looks utterly destitute by comparison. Still, wooded hillsides here invariably indicate Buddhist temples ; these self-sown woods are usually very heterogeneous and broad-leaved. The same conditions exist north of Hengchow. Where the red sandstone hills are bare a few stunted pines can always be found. Other hills apparently identical have fine plantations, and round farmsteads camphor and liquidambar grow luxuriantly, the former to gigantic size. The replanting of these hills is, therefore, seemingly not an impossible matter, whether on the sandstone or limestone which prevails in different parts. Unfortunately, in the wooded parts forest fires are of frequent occurrence, and are certainly intentional—whether to destroy the cover for tigers, to burn out fur animals for trapping, or perhaps from thoughtlessness. This applies only to the wilder regions.

In Hunan the climate is too rigorous for

SPRING IN THE WOODS.

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bananas, which grow in the plains, to ripen their fruit, but the coir-palm grows well, and among the fruits, which, however, are not of the best quality, are the orange, pumelo, persimmon, peach, etc.

The great proportion—estimated at 90 per cent.—of the wood exported from the province is fir; but the hardwoods which go out include nan-mu, dalbergia, tzu-mu (*lindera*), cedrela, sterculia, oak, camphor, and ash, and, of less importance, mulberry, poplar (white and yellow), willow, liquidambar (for tea-chests), and many others. The gingko also grows in Hunan. The total value of the export trade is said to exceed Tls. 12,000,000, of which 40 per cent. comes from the Siang, and the balance from the Tzu and Yüan. The woods on the Kiangsi border are inaccessible, though some camphor-wood comes from Liuyang.

Mention must be made of the great ship-building industry at Shênchow, Changsha, and other large centres. As 30,000 Hunan junks visit Hankow alone yearly, some idea may be obtained of the magnitude of this industry. The junks are made of soft and hard woods

combined, the latter category including camphor, cedrela, ash, and a wood named " chu."

The price of wood has doubled within a few years, and the destruction of Hankow in 1911 greatly enhanced it, as large quantities were required at short notice for the rebuilding of the city. For houses of European style it is indeed as reasonable in the large towns to buy foreign flooring. Taxation is a grievance in Hunan as elsewhere. The forest land pays taxes, and the rafts are forced to pay likin at several places on the way to the Yangtze, so that, although wages for cutters and raftsmen are as low as 10 cents a day, there is an increase in price of 30 per cent. to the lake, and of even more to Hankow.

HUPEH.

The greater portion of Hupeh lies in the plain, and timber is very scarce ; and this applies also to the hills along the north of the province. But in the west the case is different. " Here," says the botanist Dr. Henry,[1] " after ascending the Yangtze for a thousand miles, the alluvial plain ceases, and a vast mountainous country

[1] *Geog. Soc. Proceedings*, vol. xiii.

begins, which constitutes a well-marked botanical region. It extends to the Sino-Tibetan frontier —indeed, to Khasia and Sikkim. The Himalayas may, indeed, be said to end at Ichang."

The following interesting description of this region is from the pen of Mr. E. H. Wilson, a Kew botanist who was attracted by its botanical wealth: "The flora of the river valley and of the flat plain east of the 112th meridian of longitude may be roughly described as sub-tropical. West of this the country becomes very mountainous. North and south of Ichang are high altitudes. Three days to the south-east is a well-defined range, upwards of 6,500 feet high, and west and south-west of this the country is deeply cut up. The north is even more mountainous. Eight days away, running almost due east and west, is the Chungtiao shan, the watershed of the Han and Yangtze. This exceeds 10,000 feet near the Szechwan boundary. There is an interesting admixture of Himalayan and European plants, the former common above 3,000 feet, and the latter nearly all relegated to the higher altitudes. . . . From 3,000 to 7,000 feet are to be found woods composed of

the familiar trees of our own woodlands: oak, birch, beech, ash, hazel, chestnut, willow, etc., together with rhododendron, magnolia, etc. On the slopes of the higher mountains from 7,000 to 10,000 feet the remains of forests are to be met with. These remnants consist either of mixed trees (i.e. oak, hazel, birch, poplar, beech, etc.) or solely of Coniferae (i.e. pine, fir, spruce); most frequently it is the latter. Of these conifers many very fine specimens occur, ranging from 100 to 150 feet in height, 18 to 30 feet in girth, and straight as an arrow. To the ordinary person it is difficult to recognize them as natives of China—they seem more like aliens from North-West America, to whose mighty offspring they are indeed near relations. The presence of such an unlooked-for phenomenon in Central China is readily explained: the scant population of these mountains have no means of transporting the timber. It is impossible to float the trees down the roaring mountain torrents, and to carry them on men's backs—the only alternative—is equally impossible. Hence they remain, relics of a departed age, reminding us of the noble forests which covered the mountain

ranges before the destructive, utilitarian Chinese overran the country."

In the plains, where timber is so scarce (there is not a tree to be seen for miles on the Yangtze where Marco Polo spoke of thick woods), supplies are imported from Hunan (chiefly of cunninghamia) and from Szechwan (hardwoods, such as nan-mu, lindera, etc.). Most of the cottages are of mud and reed-matting, with slight timber-frames, but the better houses are of brick and timber with tile roofs. The great timber market at Hankow supplies a large area both up and down the river; here the lesser rafts are united to form the great Yangtze rafts (vide under Rafts). In the Shasi district cypress, fir, and willow are used in building, and the two former for boat-building. Other trees growing on the lower mountains in the region above described, and more available, are camphor, oak, liquidambar (for tea-chests), dalbergia, pistacia, cedrela, ehretia, poplar, etc. A large timber trade (says a British consular writer) might be done in the Ichang region but for the opposition of the Government. The likin and other dues to Ichang amounted, at the time of writing,[1] to

[1] 1883.

several hundreds per cent. of the prime cost ; but even under these circumstances profitable trade might have been undertaken. Varnish, tallow, tea-oil trees, and tung grow wild in these hills. Oaks are so little valued that their price is very low, and the only use made of them is for bottom boards of canoes in the mountain streams, the other parts of the canoes being made of cedrela, or Chinese mahogany, also a valuable wood. If these trees could be sawn into planks *in situ*, their transport would be facilitated. But let it be said that improved methods of timber exploitation must be accompanied by protection of the forests, or these will disappear very rapidly.

In these rugged and beautiful mountains the thick and varied undergrowth gives shelter to a great deal of game—tigers, leopards, panthers, wild boar, antelopes, wild goats—whose skins are sent to the plains, besides monkeys, porcupines, and game-birds, valued for food or in the drug trade. Tea is also found growing in the wild state, and in the lower districts bamboos, coir-palms, and wax-trees add to the natural wealth.

The trees of North Hupeh differ in character from those of this region in some respects, as

they include the melia and catalpa of the plains, and weeping-willow along streams.

Along the barren hills of the Honan boundary the Peking-Hankow Railway Company have plantations, a provision for the future which is worthy of imitation.

KANSU.

The larger portion of Kansu is very bare of trees—in the loess regions of the two large affluents of the Wei River, in the northern districts on the Yellow River and near the deserts, and in the dry steppes of the west. Only on the eastern border of Kingyang prefecture, where the loess hills have been long abandoned to Nature since the ravages of civil strife, are there wide stretches of uninhabited country, where the scenery is of beautiful character, and game, from the leopard and wolf to game-birds, is abundant.

But the south-west of the province contains the great backbone ridge which, as the Tsingling and Minshan, is the divide between the Yellow River and the Yangtze, and these lofty ranges, with their spurs, are covered with extensive forests. The Austrian traveller Kreitner tells

in his *Im Ferner Osten* how he crossed the range from Tsinchow in Kansu to Shensi and Szechwan, passing from orchards of peach, chestnut, and persimmon, to wooded country and forests of birch, cypress, and larch, with undergrowth of hazel, wild pear, and apple, in Alpine scenery which formed an idyllic picture. On the headwaters of the Kialing and Min to the south, and of the Tao to the north, the forests extend toward Tibet. The most common trees, growing at an altitude of between 8,000 and 12,000 feet, are the spruce (three varieties), fir, cypress, pine, birch (silver and red), and poplar. On the lower slopes grow maples (three kinds), limes, and hazel, while the "holly-oak" has a wide range. The deciduous woods of the upper belts are fringed with rhododendrons, and when lower elevations are reached there is a dense undergrowth of bamboo and semi-tropical ferns.

This luxuriant vegetation is called into existence by the Chinese monsoons, which deposit their moisture on these lofty ranges. Near villages and in clearings are planted poplars on the north, and towards the south bamboo, persimmon, varnish-trees, coir-palms, bananas, and

GENERAL MA'S AVENUE, KANSU.

Planted for hundreds of *li* by the General when on a campaign, this avenue, which acts as a natural wind-break preventing dust visitation, is worthy of imitation.

(From "Through Shên-Kan," by courtesy of the authors, Messrs. Robert Sterling Clark and Arthur de C. Sowerby.)

soap-trees. Near Tsinchow walnut woods provide the material from which the beautifully carved furniture of that town is made.

On the Tao the forests are found only on the northern slopes, the conifers growing above 12,000 feet in the Minshan, which are bare from 13,000 feet to the summit. Here the wood is cut mainly by Tibetans, who float it down the Tao, Ta-ho, and Yellow Rivers in their upper waters, whereas rafting in the larger waters is done by Chinese and Mohammedans. The conifers are used exclusively for building purposes, with the exception of the cypress, which is made into coffin wood. The average size of trees cut is 50 feet in height by 1 foot in diameter, from which two logs are cut. Trees of 100 feet and 3 feet in diameter are becoming rare. Unfortunately, the Tibetans never replant, and, in addition, whole forests of young trees, measuring from 3 to 6 inches only, are now being cut for rafters, etc. This rapid and awful destruction, similar to that which has been carried out in the more civilized parts of China, cannot fail to produce evil effects unless it is checked in time.

Much wood is also used for fuel, and the birch for making charcoal, though this tree is a favourite for cart-making. The poplar is used for furniture, and sometimes in building.

From Minchow southwards to Sungpan, in Szechwan, is described by Potanin as a labyrinth of steep ranges and deep valleys, with limited views and wild Alpine country with charming variety.

KIANGSI.

This province has been described as possessing the general geological appearance of an elongated trough, with its greatest depression and outlet at the northern end, where the rivers drain into the Poyang Lake. Its area of 72,000 sq. miles is half mountainous. The old Jesuits described it as being surrounded by mountains which were almost inaccessible on the south, and covered with forests. This forested area is now reduced to the south-west and portions of the south-east, but formerly Linkiang and Juichow prefectures contained large forests.

The chief timber supplies of the province are now cut in the Kan valley, and sent down that river to the large towns in the plain and to

Kiukiang for exportation. The Kan divides at Kanchow into the East and West Rivers, on both of which there are forests. The Tao River rises on the Kwangtung border, in Lungnan district. On its left bank, in the upper waters, are the cedar or cypress forests of the Fengta Mountains, and on the right bank large fir forests, while lower down its course, towards the Sinfeng district, the forests are mixed, and nearer Kanchow is much camphor-wood. The woods extend from the right bank of the Tao across the Kiuling Mountains to Fukien. In the higher parts of this region—the Anyuan district—the forests are inaccessible as there is no water transport, but the lower parts of the Kung River valley have been stripped bare. On the upper waters of the eastern branch of this Kung River, which drain the watershed forming the boundary between Kiangsi and Fukien, there are again thick forests of mixed growth, and in the Juikin district the best firwood in the province is obtained. Continuing northward along the boundary, the Tachin Mountains are still wooded where timber is difficult of access, but westwards, in the Ningtu department, the mountains, which

are 2,000 to 3,000 feet high mostly, are quite bare, with the exception of the Wukung shan and other limited districts.

The western affluents of the Kan are in many parts very well wooded. The Chi valley, at the head of which stands Nan-an and the famous Meiling Pass—the avenue to the south—is famous for its bamboo groves, which cover the hills and are the staple of the region. The Chang River, debouching at Kanchow, drains the sub-districts of Chung-i and Shang-yu, which have extensive forests extending to the Hunan border and over. These are composed of mixed trees in the lower course of the river, and of fir on the upper waters. North of the Chang River, the next affluent is the Tso, which drains Lungchuan district, where there are also many forests. The wood in these western districts is said to be inferior to that on the eastern branches of the Kan, and in the Lungchuan forests the cedar, growing in mixed woods, is less valued.

There do not appear to be any other forest regions in Kiangsi; Yuanchow produces much bamboo and some camphor-wood, and is rich in medicinal herbs; Ining department, in the

north, has a few small forests; and Kuangsin prefecture, on the north-east, has a little wood on the Chekiang border, but these regions produce little more than enough for local use.

The principal timbers of commercial value are the cunninghamia fir, the cedar or cypress, the pine, camphor, liquidambar, mulberry, oak, pistacia, etc. (several whose native names only are known). Besides these the bamboo, tung, varnish, and camellia (for tea-oil) are cultivated very extensively. The cedar, which grows alone, is highly valued, and is used for all building purposes; the production is very large, and huge rafts go down to the Yangtze, while the home consumption is also very great. Camellia wood is used chiefly for making implements, mulberry for the rudders and masts of junks, the hulls of which are made of fir at Kanchow and other towns on the river. Pinewood is used for cheaper constructions and for its resin, while plantations for the supply of firewood are, as elsewhere in China, found on many of the hills throughout the province. Other trees, which are of rarer occurrence, are the fortunea, celtis, elm, ash, and willows on the streams in the plains,

and the valuable cedrela is also said to be found in small quantities. A kind of acacia is mentioned by travellers, and seems to be rare in China. In the plains and valleys fruit orchards are of frequent occurrence, and are especially abundant in the Fuchow region. Apricot, peach, plum, and persimmon flourish in this part, and oranges and pumeloes farther south, in the Kan valley. Tallow-trees are cultivated also in many parts of Kiangsi.

Among other forest products Kiangsi is very rich in skins—those in the market include tiger, leopard, wolf, wild cat and civet cat, opossum, raccoon, fox, badger, otter, and deer; and porcupines, wild boars, and armadilloes are also plentiful in the forest regions. Many of the drugs which the Chinese so highly value are obtained here too; Linkiang was a drug market in the time of Duhalde. Lastly, the coir-palm grows in the valleys.

The purchase of timber is carried out in the usual way in Kiangsi: the buyer proceeds to the forests and purchases a certain amount of growing timber, which is felled by the seller and dragged to the nearest stream. Here the buyer

takes it over and floats it into the larger waterways, where it is made up into rafts or loaded into junks. The expenses of transport to the Yangtze usually amount to more than the original cost, and buyers generally obtain an advance against the timber. In years when cash is short the spectacle is sometimes seen of the Kan River being full of timber that has been paid for but which the owners cannot afford to move.

In conclusion, it may be mentioned that forest fires are frequent and destructive.

KIANGSU.

Densely covered with an industrious agricultural population, and subsisting on its own vast stores of rice, wheat, beans, groundnuts, and other products, the province of Kiangsu has no woodlands. Only on hills too barren for cultivation are plantations of pine and dwarf oak, never allowed to grow to any size. Wood for building (furniture is but little used) is supplied from the southern and western provinces, though all but the richer houses are of mud or brick; and the timber for railway construction comes from foreign countries (vide Appendix). Even

these supplies are now becoming exhausted. The Chinkiang Consular Report for 1908 quotes a missionary resident at Hsüchow in the north, as follows: "Lumber, both native and foreign, has become almost impossible to get. This district has always depended on southern pine poles for house roof beams, which now can be brought up only with the greatest difficulty and expense (owing to the silting up of the Grand Canal and likin exactions). This also compels the use for building purposes of what is ordinarily sold for stove-wood, thus demoralizing the fuel market and causing great distress among the poor. It also affects the price and supply of fuel for burning bricks, which are therefore very high." On the Yangtze the people depend largely for fuel on the great beds of reeds which line the river banks.

Kiangsu, with the exception of the salt district on the coast, is not deficient in trees, though lacking woods; every farmstead and village is embowered in groves, consisting of small bamboos (in the south), fine specimens of gingko, ailanthus, liquidambar, pride-of-India, sophora, a tree resembling hornbeam, and others. Wheel-

barrows (of oak), agricultural implements (of various woods), wheels and shafts of carts (of dalbergia, when available), are made locally. The sterculia is another fine shade tree which must not be omitted from the list. The hilly country near the right bank of the Yangtze abounded in fine trees before the Taiping rebellion, and this can doubtless be replanted. Credit is due to Professor Baillie, of Nanking University, for his afforestation scheme on the hills near the old capital.

KWANGSI.

A large part of this province is covered with mountains, but many of these are quite bare, and many more thinly covered with scanty vegetation. To the north and west the land rises continuously, rising in the north some thousands of feet to the Kweichow high plateau, and there is a considerable difference in the climates of the two provinces. A fine system of rivers flows eastwards, but the valleys are mostly narrow and the slopes of the hills steep, so that the rainfall drains off rapidly, and the rivers are subject to great rise and fall. The timber trade is

concentrated at Wuchow, on the eastern frontier, whither supplies come from the forests on the Liu River and its affluent the Lung, in the north, while the Hung River sends down bamboos, and the Cassia River also produces some bamboo and wood.

Although the exports from Wuchow into Kwangtung still reach a high figure (not far short of Tls. 2,000,000), the size of timber cut is not large, and a great deal of the product goes down the river in the form of firewood. The sources of supply are now limited to the north, though the hills of the centre were formerly well wooded. Boat-building and bamboo manufactures support a large population, and timber is largely used in building, so that there is a considerable local consumption in addition to the exportation. The districts of Liuchow and Huaiyüan produce mostly pine and firs, but a good deal of camphor-wood is sent down, and it is so little valued that it is often used as fuel; there are various other hardwoods (at present unidentified), but they are mostly found in comparatively inaccessible spots. The larger timber which comes to Wuchow is mostly derived from

Kweichow province (which vide). Along the border of this province the hills are occupied by aboriginal tribes, who often burn large tracts of hilly land in the autumn in order to drive out or destroy the tigers and leopards which infest them, and this practice prevents the trees from attaining large growth. There appears, indeed, to be little, if any, virgin forest in Kwangsi. But no doubt the bare hills can be in time reaf-forested. In fact, two agricultural and forestry schools were established in 1908, one at Wuchow and one at Kweilin, but owing to lack of funds they soon came to an untimely end (vide Customs Reports). An attempt was also made to replant a hill near Wuchow, and at Tengyün, some distance above the port, a philanthropist planted a tract of waste land with 600,000 trees of various kinds in 1906. Kwangsi may be said to be fairly rich in cultivated trees. The cassia grown in the south-east corner of the province is very valuable, and the tung-tree furnishes large supplies of wood-oil from the north—Kingyuan, Liuchow, and Pinglo, which districts also produce nutgalls. The best camphor-wood comes from Szecheng in the north-west.

On the Cassia River a good deal of bamboo and fir-wood is cut and sent to Wuchow, down the rapid current of this shallow stream. The wood is rarely found on the main stream, but grows on tributaries rising in mountainous country; but even there extensive forests do not exist. Here it is rare to see a log of over 3 feet in girth, and the prices have risen very much for what is left. Dr. Hadden, of Yung-chow (Hunan), writes: "All along this river one has an exasperating sense of forest possibilities utterly neglected. At no place did one see evidence of real trade activity. Though trees abounded, there was no sign of conservancy, system, or intelligence. Miles of hillside were burnt off that should have been capable of better things, and small growth was being improvidently slashed for firewood." Mr. Lewis Byrde writes to the same effect: "In all this region the Chinese set most of the hills on fire each winter to kill off the tigers and other wild beasts. It is sometimes a gorgeous sight to see mountain after mountain picked out with a slowly moving line of flame, which often takes two to three days to work over a mountain. This iniquitous

custom must prevent any recovery of forest except in the areas devoted to timber which seem to have definite owners. I think the day cannot be far distant when the supply will nearly cease, for the Chinese say it is more and more difficult to get timber each year." In the corner of the province north-east of Kweilin (where exists the remarkable gap in the Nanshan, through which the Taipings found easy ingress to Central China) there exist extensive plantations of pine, grown for their resin.

It is a regrettable fact that Kwangsi, whose central and southern hills have already been denuded, is fast losing the remainder of her once valuable forests, and no other vegetation is taking their place, so that the rains sweep unimpeded down the bare slopes and cause disastrous floods (there is a summer rise in the river at Wuchow of 70 feet), followed by the rapid drying and desiccation of the surface. Remnants of forests appear to exist still in accessible spots even in the south of the province, as on the Wankwai Mountains on the Kwangtung border or in the Chenan prefecture near Tonking and Yunnan. If these are spared, and the barren

hills of the centre, which grow nothing else, replanted, Kwangsi may yet have a chance to develop its natural resources, in which it is rich, for in the semi-tropical climate many valuable products even now flourish, such as cardamoms, aniseed, betel-nuts, cassia, and fruits of various kinds.

KWANGTUNG.

The coast hills of Kwangtung are among the most barren parts of China. Naturally poor by their composition, they are kept so by the practice of periodically cutting the long grass and stunted bushes for fuel, and by raking over the stubble that remains and cutting out the very roots to provide fuel. On the other hand, the delta and many of the alluvial valleys are rich in vegetable productions, among which trees are represented by the dense palm-groves of the Sunwui district. These palms are cultivated solely for the famous fans made from their leaves, and the trade in them is very large, three million pieces being the average exportation. The delta produces also a large variety of sub-tropical and tropical fruits; along the East River there are

DOMESTIC SCENE, SHOWING USE OF GRASS AND BRUSHWOOD FOR FUEL.

(From "Men and Manners of Modern China," by the Rev. J. Macgowan.)

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enormous plantations of banana; both north and south of Canton olives are largely grown, and the whole district produces immense quantities of lichees, pumeloes, oranges, peaches, and other fruits, which are being exported abroad in increasing quantities. Another product of the highest importance is the bamboo, which grows everywhere, but is exported especially from the Bamboo River, an affluent which enters the West River at Samshui.

The hills lying back from the coast are wild and thinly populated; they have been well wooded in the past, and in some districts woods of considerable extent still exist. In the Chaochowfu district the timber supplies come down from Pingyün, on the Kiangsi border, and from the hills of Fungshun and Hopo, the affluents of the Han supplying the means of transport. This timber is almost entirely fir, but a little hardwood is on the market. The fir is used in building junks and houses, and for furniture, and the hardwood for making oars, rudders, fishing-net stakes, and various tools; but what camphor-wood still exists (mostly from Fukien) is here used

for printing-blocks, signboards, and ornamental woodwork. The camphor-tree is, however, abundant farther south, at Sunning. Near the centres of population the deforestation is complete in this part of Kwangtung; in fact, the hills are bare except of pine brushwood, which supplies fuel in large quantities. A very little replanting is done.

On the headwaters of the East River woods exist in many places (vide map), and at Hoyun, the confluence of the East and Little Rivers, many rafts collect on their way to Waichow and Canton. These woods are composed of fir, but the tree is not permitted to attain a greater size than 25 feet. On the lower waters of the river the beautiful Lofou Mountains are, thanks to their being a great Buddhist centre, still covered with primeval forest—the paradise of the botanist. Other hills, such as those on the Kwangsi border, south of the West River, are wooded with fir and bamboo, but without extensive forests; the central hills north-east of Canton, where the Hakkas, with more foresight than the other Chinese, keep up the groves, still contain woods of fir and oak, chestnut, camphor, and liquid-

ambar; but forests of any extent are confined to the higher waters of the North River.[1] Less than a century ago Davis, the narrator of the Amherst Mission, told of forests growing down as far south as Yingtak, but the river banks are naked as far as Shiuchow, and the timber is now confined largely to the limits of the watersheds. Fifty years ago the splendid Lokcheung gorges and the hills surrounding them were clothed with a dense growth of tall virgin forest, where thousands of men were engaged in cutting timber (vide B. C. Henry's *Lingnam*). But now all the larger trees have gone, and though the region is still wild, this wildness is due to the undergrowth which covers the hills. Much fir and spruce is still cut, but of small size. The hardwoods have mostly disappeared, and are rarely seen in the great timber market at Fatshan. Deciduous trees formerly found in these forests included oak, chestnut, castanopsis, camphor, liquidambar, wax, tallow, and tung trees. In fact, the timber trade in this region is but the

[1] A feature of these northern and central hills is the system of pinewood dams used in irrigation. Some of the rivers contain hundreds of dams.

shadow of what it once was ; in comparison with what might even now be the timber is disappointing, as huge areas, though apparently intended by Nature for heavy timber, are entirely destitute. The chief reason for the cutting of timber while still young is the poverty of the owners, who have often fallen into debt. There is a certain amount of replanting done on the North River, but nowhere is there to be seen the same strenuous afforestation that is practised in South Hunan. One obvious reason for the treelessness is the firing of the hillsides, which is carried in Kwangtung to a greater degree of destructiveness than elsewhere. These fires are often attributed to the carelessness of passers-by, and roads make for fires, as people set fire to overhanging reeds and grass, so that one may see the side of a valley where the road goes quite bare, while the opposite side is heavily wooded. The small fire-balloons set off at the Feast of Lanterns also start disastrous fires. But some at least of these fires must be due to the wish to drive out game. Tigers and leopards still abound in the Kwangtung hills ; indeed, not more than twenty miles from Canton the former are common. But the

export of skins from the northern hills has much diminished, though pig, antelope, wild dog, fox, civet, opossum, and hare exist in the woods, and deer-horns are still brought in in large quantities.

More timber comes from the Namyung branch of the North River than from the Lokcheung gorges, though there are now no more of the 100-foot logs mentioned by the historian of the Macartney embassy, who so admired the forested hills on this river. But the best-timbered areas are those of the third branch of the North River —that which runs down from Linchow from its sources in the mountains of the Yao tribes. These hills have never been penetrated for more than a few miles by outsiders. They are covered with dense, dark forests, filled with game of all kinds. The Chinese from the Linchow valley go in bands to cut timber and firewood, but the timber from the inner hills is brought down by the tribesmen, who also collect medicinal herbs, skins, and deer-horns. Wood boats are anchored at the mouth of every small stream, awaiting supplies of firewood or planks, and rafts are formed on the larger streams. The undergrowth

on these hills is largely a type of pampas-grass, 6 feet high, which affords excellent cover for tiger, bear, boar, and deer. Monkeys and armadilloes are found too. Where water transport is lacking, the Yaos often carry planks and even 10-foot logs many miles to find a market. Unfortunately, the outer ranges of the Yao hills are now as bare as any others, and as subject to fires.

In the Chinese timber districts the cutting is not done by companies but by traders, who buy a hill or a section for a lump sum. The cutting is mostly carried out in July and August, when the logs are stripped of their bark and stacked until dry enough to float in a raft. When a large stream is not available, the trees are cut into small lengths for firewood—this shocking waste of good material occurring near good coal districts! The wages of cutters are from 40 to 50 cents daily and of raftsmen 30 cents, and besides, the trader divides one-tenth of his profit at Fatshan among the men.

The best feature in the hills is that behind nearly every hamlet there is a grove that is *fengshui* (sacred), and no one is allowed to cut

the trees. In many parts even the trees that have fallen are not cut up, but are left to rot. In the thickly populated parts of Kwangtung these groves are the only places where large trees are seen. In some cases a considerable area of the mountain-side is fengshui. This is the sole check on a utilitarianism which is caused by the pressure of over-population.

Among Kwangtung trees which deserve notice are the various palms of the delta (vide under Palms). The banyan is a much-prized shade tree which flourishes all over the province. It is found right up to the mountain barrier on the Kwangtung side, but never in Hunan, where the climate is several degrees colder. Even in the gorges, where it is, in the picturesque Chinese phrase, " One coat colder " than at Shiuchow, bananas ripen.

One of the most interesting and valuable, but at the same time little-known, parts of Kwangtung is the Island of Hainan. The central and southern portion is occupied by ranges of densely forested hills, inhabited by aborigines. These hills are densely forested, but their wealth has never been tapped, or, indeed, properly investi-

gated, though Chinese officials have of late years made attempts to examine the conditions for the purpose of exploitation. A commercial report says: "Valuable woods are known to exist—mahogany, rosewood, both red and white cedar, a very beautiful wood resembling maple, and several tougher kinds not unlike oak and ash. There are also reported to exist forests suitable for supplying sleepers. But as the island watercourses are shallow and at certain times of the year dry, and as there are no roads, it is practically impossible to bring heavy timber to the coast through the dense vegetation that covers mountains, valleys, and slopes for miles. The problem of transport is one that has to be solved before there can be any chance of the virgin forests yielding up their wealth. Apart from occasionally acquiring a few highly prized boards for making coffins, the natives have been content to centre their interests on "fragrant-wood"—probably garoo-wood, which has undergone some treatment while growing. Fabulous sums are paid for this throughout China—as much as $200 per catty for the fine qualities. It is usually sold in small pieces, irregular in

Photo by] [*Mrs. Cecil Holliday.*

STORAGE PLACE FOR COFFINS, SHOWING THE GREAT THICKNESS OF THE WOOD.

(From "In the Land of the Blue Gown," by Mrs. Archibald Little.)

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size and shape, and used chiefly for making beads. The wood is soft and contains a volatile oil. The chipping and dust go to make joss-sticks. Cedar-wood, for making pencils and cigar-boxes, might be brought out in pieces easily carried." Experiments have shown that economic plants from Singapore could grow well in Hainan, and rubber and camphor should be cultivated.

KWEICHOW.

Kweichow is not a well-wooded province, but in its south-east corner contains a large forest area, which is being very actively developed. A large portion of the province was until recently in the hands of the aboriginal tribes—Miao, Chungchia, etc.; but the children of the Chinese soldiery sent to suppress the great rebellion a generation ago, who intermarried with the Miao women, have obtained possession of fields and forest land by money-lending and seizing the land mortgaged to them. In this way the timber of Liping-fu has come into the market since the suppression of the revolt. There are two outlets for this timber. The first is by the Yüan

River to Hunan. Most of the timber sent out this way is small, not many trees being over 1 foot in diameter. The wood is chopped on the ground and trimmed up to about 2 or 3 inches diameter and then rafted down full length. Hungkiang, in Hunan (which vide), is the great mart, and buyers go there from as far away as Shanghai. This timber is all cultivated. The seed is planted in beds and the seedlings transplanted when only from 3 to 4 inches in height. The ground is cleared of grass for four or five years, after which the trees shift for themselves until marketable. On good soil they are a fair size—say, about 9 inches—in about fifteen years. Trees of this size will bring in less than 10 cents each, standing on the mountain-side within sight of the river. Timbermen are paid about Tls.3 per month and all found. Rafting is done by contract and varies with the character of the run.

The second outlet is the Kuchow River, which runs southwards into Kwangsi. Here a great amount of beautiful large timber is being run out, much of it from $2\frac{1}{2}$ to 3 feet in diameter. The Chinese themselves say that there will be

none left in ten years. This large timber is cut into lengths of 18 or 24 Chinese feet, and much of it is sawn into two slabs before moving. In the Kuchow district cutting is done by digging round the base and cutting through the roots, thus keeping the gnarled butt. The timber is dragged to creeks or rivers on trestle-work slide-ways (the only instance of which information has been obtained of the use of this method), and this dragging is the most expensive part of timbering—that is to say, with the exception of the likin, or local taxes. Only the finest sticks can be profitably dragged more than two or three miles. Floating down small creeks in this district is managed by building frequent dams with a movable section of loose but close-fitting upright bars. When this section is suddenly removed the rush of water drives along the float of fifty to seventy-five logs for some distance, and in this way they are gradually rushed down the river. Even these large trees are worth a mere trifle standing. Likin charges are very heavy—to Canton above twice the entire investment in the timber, but to Hankow rather less.

The bulk of this timber is coniferous, but there is a good deal of oak and camphor, with ash, elm, chestnut, walnut, etc., and the coir-palm grows in the valleys in Kweichow. The fir-wood growing along the main Tsing River is said to become red after soaking, and is therefore more highly valued than that along the side streams, which remains black. There is here also the semi-petrified wood—along the Upper Yüan River. It has been buried so long that it has lost its grain and changed to a colour ranging from dark cherry to black. This is valued for coffins on account of its preservative power, and the coffins made of it at Chenyuan are sold at Hankow for Tls.200 to 500. The wood is also used for carving.

There is but little other wooded land in Kweichow: a district on the Hunan border in Sungtao department sends some wood to Shên-chow, on the Yüan, and a little farther north the thinly populated hills of Chengan send some wood down to Fuchow, on the Yangtze. The hills are well wooded in parts with cypress, fir, or oak, in others with varnish and tung. The area between Tungjên and Chenyüan was for-

merly covered with a dense growth of trees, but here, as on the hills north of the capital, the woods were demolished during the Miao revolt on account of the shelter they afforded to the rebels. The soil on many of the hills is too poor and thin to support a heavy growth of trees, and the wealth of Kweichow lies rather in its quicksilver and other metalliferous deposits. The absence of good waterways is another obstacle to the growth of the timber trade in the province; the result is that wood is very cheap locally. To the east of Chaotung, in Yunnan, there are many woods in Kweichow, with the fir family mostly in evidence. Here a correspondent bought a hillside of trees (2,000) for Tls.40 only. Some of these were 70 feet high and gave planks of from 8 to 14 inches in width, and another purchase was $120 for 1,000 young firs, which would be valuable for building in a few years from the date of buying. Farther north of this district where trees are sold for a song is a considerable timber district, belonging for the most part to Szechwan—the Jênhwai part of the Kishui River. Here the nan-mu is still found in some quanti-

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ties, and indeed this valuable tree grows throughout all the wilder hills of N. Kweichow. The gingko, mulberry, "olive," and some coir-palms grow in the same region, and in some parts of Tsuni prefecture wild silkworms are cultivated on the same oak (the ching kang) as that used in Manchuria in the silk industry. This tree is then dwarfed, but grows, when let alone, to a height of 100 feet, and is much valued for charcoal. Bamboos grow everywhere in the valleys of the south, where persimmons are also found. Tea-oil is a product of the central valley, but the wood-oil derived from the tung-tree is the chief vegetable export of the province; the tree grows wild throughout the province, and a great deal of the oil goes to the Yangtze from the north, where the tree grows in profusion on the rocky soil, to which it is suited. Resin is another useful product of the woods, and among other subsidiary products are lichens and deer-horns, while there is an abundance of furs and skins, the principal animals exploited being antelope, bear, wild cat and dog, deer, fox, wild goat, jackal, leopard, monkey, musk-deer, polecat, squirrel, tiger, weasel, and wolf. As else-

where, the thick undergrowth and bracken are burnt nearly every winter to drive out the wild beasts.

MANCHURIA

The political events of the last twenty years have concentrated attention on South Manchuria to such an extent that the northern province of that vast region has attracted but little attention. And indeed most of Heilungkiang is very little known. A large proportion of the northern Khingan Mountains and the Little Khingan are covered with trackless forests, where a few Daurian (Tartar) tribesmen live by hunting the fur-bearing animals, including the sable, which was in the past an important tribute staple in these regions. It has been estimated that the Khingan forests have enough timber to last for hundreds of years, even at a high rate of cutting. But no scientific investigation of this forest wealth appears yet to have been made.

The Khingan, which forms the border-range fringing the lower terrace of the great Central Asian plateau towards the plains, is of peculiar interest as a line of division between two floristic

regions. Its western slopes have scant vegetation in the form of Alpine pastures, the only trees present being the Siberian willow and thorn scrub. But as soon as the descent is made on the eastern slopes in Manchuria the warmer climate brings a new flora, and trees grow freely even on the plains; while the mountains are covered with great forests of fir, larch, and broad-leaved trees, such as oak, walnut, lime, hazel, myrtle, etc., and several new species of poplar, willow, acacia, etc., appear.

South of the Siberian Railway the steppe-lands of Mongolia project into Manchuria. This is the great grazing and wheat-land of the future, and it is continued up the valley of the Nonni and other affluents of the Sungari which flow southwards from the Khingan Mountains; but eastwards are the mountains, which follow the course of the Amur and cross that river into Russian territory northwards to the Sea of Okhotsk, while other ranges run southwards to the Liaotung Peninsula and Korea.

Wherever available the timber on the Upper Amur and middle Sungari, and along the Chinese Eastern Railway, has been cut away for use as

fuel on the river steamers and trains. But in the interior mountains between the Ussuri and Sungari the immense forests remain untouched by the hand of man, save when the hunters set fire to them to drive out the game. Ravenstein, in his book on the Amur, has described the order of forest vegetation in the various zones of the Amur, and he enumerates four of these on the Amur above the Ussuri. The first extends from the junction of the Shilka and Argun to the point where the river takes a southward direction. Here the forests are thin, with scarcely any underwood. Larches prevail on the mountains, with firs in dry situations, and in the valleys the white birch, bird-cherry, and aspen. The trees are of slow growth and rarely large. It is noticed that this Manchurian vegetation is seeking to spread westwards to the high Asian plateau up the river valleys. In the second zone, following the river downwards to Aigun, though larch and fir grow on the hilltops, conifers are rarer, the larch is replaced on southern slopes by birch and oak, and at the foot are found elm, ash, hazel, etc., with poplar and willow in damp places. South of this is a low-lying region as

far as the Little Khingan and Bureya Mountains, which form the limit of many plants peculiar to the Upper or Lower Amur. Thus the Manchu lime, all the maples except the Tartar maple, the cedar, the ribbed birch, etc., are not found westwards of the range, while the Scotch pine, etc., do not extend below it. On the Ussuri, which forms the eastern boundary of Manchuria, the oak is very prevalent, and farther south, near Lake Hanka, it forms large forests of splendid trees. Other trees in this Ussuri region are the elm, lime, bird-cherry, maple, aspen, birch, walnut, and cork-tree (q.v.), and many fine conifers. These forests, which can be tapped by two lines of Russian railway, are of interest because they are contiguous to a district where timber is shipped abroad, and possibly some Chinese timber may have been included in the shipments ; at any rate, there is here an opening for the development of an export trade. In 1909 parcels of local timber—pine, fir, oak, ash, and walnut—were sent to Europe (England and Germany) from Vladivostok, and three whole cargoes of larch, spruce, and fir to Australia. It will be interesting to watch the course of this

USE OF LIGHT RAILWAY FOR LOGGING IN MANCHURIA.

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experiment, for, in view of the growing scarcity of timber in Europe, the demand for Manchurian timbers may spring up from these humble beginnings in the Russian province. The Consular Report which gives the above information tells also of the establishment of works near Vladivostok for the manufacture of veneer, three-ply, and match-sticks—the last from aspen. The large quantity of spruce available should lead to the establishment of pulp-mills in the near future ; an excellent market is at hand in Japan. The ornamental woods—oak, ash, and walnut—are generally admitted to be superior to the Japanese varieties. These remarks apply, it is true, to the timber of the Maritime Province of Siberia ; but as the forests mentioned are merely continuations of those of Manchuria, the same holds good for the latter, and future generations may see a considerable trade from the whole of this timber region.

Leaving the Ussuri region and passing over the wild range through which the Jesuit De la Brunière went to his death in 1845, the valley of the Hurka is reached, where the commonest trees are birch and oak below and pines on the

summits of the hills. Across the railway to Ninguta the country is becoming dotted with villages, but "westward up to a point only fifty miles east of Harbin is a continuous solid belt of mountains and hills covered with dense forests, at places over 150 miles in breadth, and practically impenetrable."[1] The same conditions exist to the south, along the Hurka-Sungari watershed, though there is a trade route connecting Ninguta with Kirin, the provincial capital, and it is here that a new railway is projected as a branch from the Russian main line. This watershed is a spur from the Changpaishan, the backbone range which runs south-west until it loses itself in the Regent's Sword—the end of the Liaotung Peninsula. From the heart of this range runs the Sungari, the romantic river described by the English traveller James in his book, *The Long White Mountain*. The peak which gives its name to the range is 8,000 feet high, and was extolled by Younghusband as having its "sides covered with exquisite meadows and copses, excelling Kashmir." These mountains contain two great timber areas—that of the

[1] Extract from *North China Herald*, December 13, 1913.

Yalu and that of the Sungari. The trade of the latter centres round Kirin, which is about 300 miles below the source. One of the chief industries there is junk-building, from which Kirin derives its name of "the dockyard," but the making of ornamental furniture is one of the specialities of the place, and there are many shops full of beautiful oak cabinets, chairs, and small tables, and with the excellent resin from the pine lacquered presses, boxes, etc., and even coffins are produced in great numbers.

Twenty years ago timber was so cheap that, as Hosie remarked,[1] it was used for the gigantic fencing of houses and compounds. The Consul pointed out that had the carpenters but possessed decent nails, at least two-thirds of the valuable timber thus used could be saved for other purposes. But since then the demands of the growing population have caused a shrinkage in the timber area near Kirin, and the edge of the forest is being pushed back as the army of colonists—the overflow from the plains of China—advances. These regions, once the old home of the Manchu dynasty, were closed to immi-

[1] *Manchuria*, by A. Hosie.

gration until early in last century, but their opening and the construction of the railways on their borders has been the signal for the rapid cutting of noble forests.

South-west of Kirin is the great upland plain of Hailung, the ancestral hunting forest of the Manchus, preserved as jealously as the New Forest in England until a recent date. This fertile area has not been ruined yet by the total destruction of wood, but the colonists are now at work destroying the forests, and should the projected railway be built, the denudation will soon be complete unless the Government steps in to check it. Farther south, along the Hun and Taitzu Rivers, where formerly much timber was rafted down to Mukden and the other cities of the plain, very little is now available. The great forests now begin nearer the sources of the Sungari, and extend thence to the Yalu. No large trees are now left anywhere near the banks of the main river, and the real timber area of Kirin is now estimated to be only 60 miles in length by 30 in breadth, though the corresponding figures for the less available Changpaishan forest are 125 by 90, and eastwards towards

the Tumen are still vast stretches of primeval forest. Agriculture was not permitted in the Hunchun region until a generation ago, but the hills near that centre are now quite bare.

To return to the Kirin forest, the chief trees (for details vide Part II), are, among conifers, red pine, spruce, and larch, of which the last grows in the depth of the forest and is not very available, while the first two are very numerous, and grow to 80 feet in height. The ample supplies of moisture which these mountains receive are very favourable to the growth of broad-leaved trees, among which oak, ash, walnut, and maple are the most conspicuous. The oak is important on account of the fact that the rapidly extending wild-silk industry depends upon this tree for the feeding of the silk-worms, and as the forests recede, silk cultivation may replace timber production. Another important tree is the poplar, which is coming into demand in the match industry, for which the white variety is most suitable. This tree is widely scattered in the swampy valleys of the Sungari region, and has also been spared in many localities where the rest of the forest has been swept away.

From the red and yellow pine and the larch junks are constructed, and from the cheapest pine stout oil boxes for the bean-oil trade.

The timber market is well organized at Kirin; the regular method in vogue is for the merchants to contract with a *patou,* or headman of a gang, for the supply of wood. The patou obtains a supply of tools and men, who proceed to the hills in the early autumn and open tracks into the forest, building roads wide enough to allow the passage of a sleigh. Cutting begins in mid-winter. The only practicable method of reaching the streams is by the use of sleighs; these are made on the spot by the gangs, and are some 8 feet long by 3 in width, with shafts 15 feet long, bent upwards. The horses or oxen used are supplied by the pioneer settlers who live in the forest, and three animals are capable of dragging a load of 7,000 lb. on the frozen roads. On arrival at a stream rafts are formed and sent down with the spring freshets to the main river, where larger rafts are made up for the journey to Kirin. There is great wastage owing to the current being slow, and many logs are thus left stranded to rot away. Owing to

the danger from robbers, drought, or flood, the workers prefer to receive fixed wages instead of sharing the profits, as it is reported that one-third of the timber is lost *en route*. Wages range at $20-40 per month for a patou down to $8-12 for an ordinary workman, food being included free. This is supplied by the settlers above mentioned.

The rafts take eighteen days to reach Kirin from the junction of the two main affluents, but in dry seasons sometimes as long as two months. From Kirin the wood is conveyed in junks (of which there are 1,500) to the plain; the river steamers run irregularly owing to the bad condition of the Sungari, and are not much used for timber transport. But the chief markets are in the south, whereas the Sungari runs north, and the opening of the new railway connecting Kirin with the main Japanese-controlled line (the South Manchuria Railway) should alter conditions here. At present much timber is sawn into planks—mostly coffin-wood—and taken by cart from Chaoyang, which connects with Kirin by water.

At Changchun, where the Russian and

Japanese railways meet, each of these nationalities has an extensive lumber yard, supplied from the forests in the north and east; from these the plains in the south are supplied by rail. The annual output of timber in the Harbin district is estimated at Yen 3,000,000 and that of Kirin at Yen 6,000,000 (*Manchuria Daily News,* June 1, 1912). In the non-forested hills bordering the plains, and in the low-lying country itself, there are many trees scattered round the villages and farmsteads. These are mostly oak, elm, and willow, with the ubiquitous fire-wood pine. Fruit-trees are abundant, and the district near Liaoyang is especially noted for its orchards of pear (one variety—the hsiang-shui li—being famed for its sweetness), peaches, plums, apricots, etc. The whole of South Manchuria is well adapted, from its climate, to become a good fruit-raising district. An experimental station under American management was inaugurated near Antung recently, and it is to be hoped that this scheme will be the beginning of a development in the right direction. The South Manchuria Railway has also an experimental fruit (and other) farm at one of its

stations, and here experiments have been carried out with a view to improving local fruits, and also with the "golden willow," which is largely used in the basket-making industry, an important one in the silk districts.

The timber from the Yalu forests, exported from the treaty port of Antung, is now the most readily accessible, for exportation, in China—that is to say, where logs of large size are concerned. The following account of the opening of the industry appeared in the Antung Customs Report for 1907: "The local patriarchs assert that so far back as 1823 the Emperor Taokuang sent axemen to fell the Yalu timbers for his palace. Next, in 1845, came two Shantung men, Chao and Ma, who set up at Mashitai (just above the present Antung) as collectors of the tribute of two logs out of every ten which they required from their five hundred followers, and, later, from all others who were attracted to the lumber business by tales of the wealth which was to be gained; in fact, no one was allowed by them to fell the trees unless provided with one of their enabling certificates. These first rafts made their way down the river to its mouth, and some way

along the coast towards Takushan, where the wood merchants from Shantung and Chihli provinces congregated. Thus these two were supreme until others more valiant, in 1854, opened operations near the river's mouth by simply forcibly seizing the rafts coming down and making themselves pilots for the rest of the journey to the market. In 1856, though, one Chu, a woodsman, resolved to clear out this band of robbers which had kept his rafts from coming down in the two preceding years. With his seventy co-workers he made guns out of elm logs and defeated the robbers. But the rafts were weakened by the recoil of these guns and had to lie up at Tatungkow, where the market became established in what proved to be a very suitable situation." Thus the history of the Yalu valley is practically that of the timber trade, which continued to pass through various vicissitudes until it came under the control of the Russians, under whom it developed considerably owing to the requirements for building the towns of Port Arthur and Dalny. Later on the control of the trade was taken over by the Japanese military authorities, and finally, in 1908, a Sino-Japanese company

LOGGING BY KOREANS ON A TRIBUTARY OF THE YALU, MANCHURIA.

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was established, which, as a semi-official organization, works a strip of forest 20 miles wide above Maoerhshan and controls the sale of all the timber of the entire Yalu basin.

From Antung to the centre of this lumbering district is somewhat over 200 miles by river. The Yalu has a rocky bed, with a swift current as far down as the mouth of the Hun, its principal tributary; below this it is sandy and deeper, though always liable to shallow. There are numerous tributaries, down which timber is rafted; on the Hun, which is 300 miles in length, considerable difficulties are encountered from rapids when there are floods, but, on the whole, rafting presents little difficulty. The Changpai Mountains, at their western extremity, connect with other ranges, in which the Huifa and Meng Rivers rise; and this mountain system is a land of dense forest and swamp, almost impenetrable and containing vast, untouched stores of timber. The destruction of the forests on this side of South Manchuria has been as rapid as in the districts farther west. The Lower Yalu region was constituted a no-man's-land by the Manchu Emperors, after their conquest of China, with the

purpose of forming a boundary between their dominions and Korea. These forested wildernesses became the home of bold outlaws until about the year 1870, when, colonization having begun to take hold of the territory, the Government stepped in and established administrative centres. At Antung, where a magistracy was set up in 1875, splendid groves of oaks and other trees still covered the hills in 1864, but soil erosion is now taking a firm foothold on the barren hills of the whole district. The districts of Kwantien and Hwaijên have since been absorbed by the army of settlers from Shantung, and the real forest region where timber is available under present methods of transportation has now been pushed back to the upper waters of the Hun and the other tributaries of the Yalu in Manchuria.

A large variety of trees is found in the Yalu forest—the Lumber Company gives a list of over twenty. The bulk of the timber cut is spruce and silver fir (said to be 60 per cent.) and pine (30 per cent.), besides larch, and among broad-leaved trees ash, birch, elm, lime, maple, poplar, oak, and walnut. Rarer trees are the

cork-tree (*Phellodendron*), plum, acanthopanax, and yew—the latter called the king of Yalu timbers. On the Korean side the timber appears to have been exhausted long ago, except in the mountains far from the river; here W. R. Carles, in 1885, found splendid zelkowas and silver firs 150 feet high, besides birch, maple, mountain-ash, and oak. The region in the vicinity of the high peak from which the Ever White Mountains derive their name is composed of volcanic soil, and here the mountains are thickly covered with larch, giving them the appearance of bamboo-groves. The dry soil and southern slopes favour this tree, which is found in great quantities here and going westwards, where, however, at the first affluents of the Yalu on the Manchurian side, it is mixed with red pine and fir, which soon predominate. Broad-leaved trees are rather rare until somewhat farther west, when many birch grow on the summits and large poplars below. Lower down the river come ash, elm, walnut, etc., though the conifers, except the larch, extend over the whole district.

Methods of Working.—The Customs Report already quoted says: "Lumbermen use either

their own capital or that of the manager of a wood-hong (in the latter case interest is often 40 per cent., as the manager must take the risk of total loss—by storm, flood, etc.). The headman gets from 70 to 80 Tls., with a share of the profits. He, in turn, employs a 'properties boss' at from 50 to 70 Tls., charged with all matters of provisions, implements, pay, and accounts; a hill boss at from 40 to 50 Tls., who superintends the actual cutting; and ten choppers, who are staked with food and clothes by the hong manager till they can repay out of their share of the profits. After the party has been formed and all preparations made, it sets out from Antung in August on its long tramp to the forests, which are reached early in September. Huts are put up and tracks made, and cutting begins at the end of the month, so that advantage may be taken of the winter snows. There is keen competition among the gangs to get the timber to the waterside in the shortest time. Each gang fells and finishes 80 *fu* (880 8-foot logs or 440 16-foot logs), or an equivalent admixture of these and longer lengths. To finish the job properly half

of this number must be on the river bank by the beginning of spring, so that the rafts may be formed by the time the ice has broken up." Each gang consists of about twenty men, but local coolies are employed to open the roads and drag the logs. These are put into the small streams, stamped with individual marks, and on arrival at the larger rivers the logs are pulled out with ropes and formed into rafts, the gangs sometimes helping each other in the earlier stages. (For an account of rafting vide Appendix.)

The following general remarks as to the forests are from the British Consular Report for Antung, 1908: "Want of scientific knowledge and ignorance of the laws of forestry have undoubtedly been a serious handicap to the development of the lumber business under the purely Chinese regime. Such an anomaly, for instance, as the importation of sawn planks of Oregon pine into a port which taps one of the world's large forest districts, where all kinds of pine are to be found in abundance, is a standing example of China's inability, or want of enterprise, in developing her own resources. It is

noticeable that wherever there is a waterway suitable for floating timber, the forest has already receded and there is no large timber left. There has been no reafforestation, and the timber-cutting has been conducted in a very wasteful way. The logs have often to be drawn a distance of ten miles to the nearest stream, and there wait months for the first freshet on which they can float down singly to the nearest rafting station. Innumerable beasts are employed in drawing logs through the forest along the log-hauling paths—ponies, mules, donkeys, and oxen being harnessed together indiscriminately. In some cases the logs are placed on rude sledges." The methods of cutting and rafting are also wasteful, and are said to involve an unnecessary loss of 35 per cent. in the squaring of the logs, in the method of binding them together, and in the neglect of good top ends. Besides, all the bark, slabs, riflings, and dust is left to rot. As regards the deforestation referred to, red pine—the most profitable wood in large quantities, and therefore the first cut—is no longer to be found near the Yalu main river, and but little fir, while within ten miles of any town even fuel is difficult to

obtain. Reafforestation is said (in the Consular Report, 1907) to form part of the Japanese scheme for the exploitation of these forests. "The question of the permanent supply of timber is a serious one for Japan, having regard to the very large annual requirements for the construction of the wooden-built houses of Japan. Japan has in her country the forest of the Hokkaido, where reafforestation is carried out by the planting of saplings, to be cut every thirty years. In the forests of the Yalu the Japanese propose to apply the system of leaving standing such trees as are suitable for propagating the seeds." "Japan has for long built great hopes on the working of these forests, and it is hoped that they will now, under Japanese management, take the prominent place they deserve in the lumber market of the world" (1908 Report).[1]

[1] The Consul has, however, failed to point out that a great deal of Japanese timber is imported to China. The number of logs sent down to Antung yearly has been estimated at 1½ million. There are well-equipped saw-mills both at Antung and on the Korean side of the river near its mouth. The timber finds a market chiefly in China, Chefoo having been the only market until the last generation, but Tientsin now takes the largest proportion, and the whole Shantung coast is supplied,

MONGOLIA.

The usual conception of Mongolia is that of one vast treeless, sandy desert, but Mr. D. Carruthers, in his *Unknown Mongolia,* has shown that this description applies only to one region—viz., that of the depression in the great plateau which is named the Gobi. This zone occupies about a quarter of all Mongolia. Even here pasture appears in the spring, but the great pasture-lands lie south and east of the desert, in a zone which is rapidly becoming Chinese, and destined perhaps at some future date to be a great wheat country. Another zone of pasture lies to the north of the desert, and leads to the fourth zone, which Mr. Carruthers calls the true Mongolia, the ancient home of the race, where history may yet be made.

In the greater extent of the Gobi there is not a tree to be seen, but in the two pasture zones above referred to small elms and dwarf willows are to be found along watercourses in

and even Shanghai, whence the Chekiang-Kiangsu Railway sent large orders in 1908. Some is also exported to the Korean coast towns by the Japanese.

some localities. It is recorded that at one time these regions had their own forests—the Jesuit writers of the seventeenth century tell of oak, pine, aspen, and elm woods in South Mongolia; and Kovloff states that the ancient city of Khara-Khoto stood on the banks of a river where virgin forest grew in 1500, until it was destroyed by the invading Torguts. Kobdo, in the north, was formerly covered with wood, and in the north-east the banks of the Kerulon are still wooded to a slight extent. It is the same tale of neglect and desiccation, but there is no reason why trees should not again become plentiful in these regions. On the sources of the Liao, where the advancing Chinese agriculturists are occupying the grass lands, willows and cotton-woods are planted by the colonists, and in a few years become fine groves of trees which modify the air and act as a break to the terrible winds which blow the seed grain out of the ground. Farther west an object-lesson has been given in at least two places by the Catholic missionaries. At Sing-ho-cheng the Fathers have planted poplars, elms, and willows, which have been reared with fostering care and form fine groves; and at

Santaoho, on the summit of the Yellow River's great bend, the Belgian priests have succeeded by dint of great labour, by planting trees and by excavating irrigation canals, in redeeming from the sands a large tract of arable soil.

The fourth zone—the ancient home of the Mongols—is where the plateau reaches its highest elevation on the north, and, coming under the influence of the Siberian climate, possesses splendid forests of pine, spruce, aspen, birch, etc., abounding in valuable fur-bearing animals, as well as moose, wapiti, and even reindeer. From these Syansk Mountains, with their northern character, there is a gradual transition—through the second step to the plateau (the Tannu-ola Mountains)—to the flora of dry regions. Here the larch replaces spruce, and broad-leaved trees are found only near the waterways. Finally the forests lose their hold of the southern slopes, and the steppe flora triumphs. In the far distant future these Upper Yenisei forests may obtain an economic value for their timber, but only when means of communication have altered their character. The factor of general desiccation will have to be reckoned with

here, as farther west, for Mr. Carruthers noticed that the steppe flora was gaining on the forest, and that the glaciers appeared to be receding and the lakes drying up in the mountains.

To the west the ranges merge into the Altai, which near Kobdo is divided into two widely differing parts. The western is very lofty, with glaciers and snowy peaks, and receives large quantities of rain and snow, and is covered with vast forests of spruce, pine, cedar, larch, birch, and aspen. These valuable forests are, however, mostly in Russian territory, where they are Crown property. To the east of Kobdo the Altai rarely reaches the snowline, and, owing to the prevalence of the winds from the desert, has but few forests. The only trees which flourish on the lower parts are the tograk and willow, in the camel pastures.

SHANSI.

This province has been without wood for centuries, and its wealth lies in its great carboniferous strata. But the good climate and loess soil produce in some regions excellent fruit-trees. The south-western corner of Shansi is famous

for fruit; for many miles immense orchards stretch unbroken over the land, causing it to resemble one huge park carefully laid out. Persimmons prevail here, but there are also peaches and apricot-trees, and in some parts apples are the chief constituent of the orchards. In the Taiyüan plain there is also much fruit. Other trees are the sophora, walnut, cypress, willow, and poplar.

The scarcity of wood has doubtless been an important factor in bringing about the practice of cave-dwelling so prevalent in the loess region. The coal-mines possess an advantage which reduces the expense of timbering in them to a minimum—viz., the seams are overlain by hard sandstone, which forms a solid roof.

It is in the north that desiccation, due to treelessness, is more particularly prevalent, and yet forests, first penetrated by the Clark-Sowerby expedition, still exist on the lofty mountain range which bounds the Yellow River basin on the west of the province. These Yün-ting shan forests are composed of pine and fir, larch and spruce, with hazel-scrub interspersed. They begin mostly at 7,500 feet, and grow on

the northern slopes, extending to the tops of the ridges. The southern slopes are grassy. Poplars and scrub oaks are found in the valleys or at lower elevations. This timber is used for fuel, but not for building, as transport does not exist; it is needless to remark that to this circumstance alone do they owe their continued existence at this day. Could they but be retained and extended, something might be done yet to rescue the province from the peril threatened by the desiccation spreading southwards.

The following passage from Professor Ross's *The Changing Chinese*, pp. 270-3, tells in eloquent fashion the story of the havoc wrought in Shansi and the adjoining provinces by deforestation :—

" Nowhere is the havoc wrought by deforestation more evident than in North-west China. Around Taiyüanfu all the once-wooded mountains are bare and bone-dry. Down through the province one sees no trees on mountain or foothill save those about temples. The original hardwoods are all gone, so in the valley one grows cheap soft woods—poplar, cottonwood, basswood, box-elder, and willow.

"Once the tree cover is removed, the rains wash the soil from the hillsides and with it fill the watercourses and choke the valleys. Wherever a brook or a creek debouches into the valley of the Fen it has built with this wash a great alluvial cone, curving down-river, and along the crest of this cone runs the shallow gravelly bed of the stream that once loitered under high banks three or four fathoms beneath its present level. This cone has covered under silt and sand and gravel from a few score acres to several square miles of the former rich bottom lands, and they can never be recovered.

"Buildings are buried to the waist in the debris. Gateways that once one could ride a camel through one can now only creep through on hands and knees. Twice we came upon majestic stone bridges which once spanned broad affluents of the Fen, but which now, their noble arches half silted up, stand unused amid fields of beans and rape, sad monuments of a bygone prosperity. Since the bridge was built 20 feet of wash from deforested hills has been dropped in that watercourse, and the stream, no longer fed from spongy wooded slopes, is a trickle or

A HALF-BURIED GATE-TOWER.

(From "Changing China," by Edward Alsworth Ross, by permission of the Century Co.)

A SILTED-UP BRIDGE IN SHENSI.

One of the ultimate results of deforestation.

(From "Changing China," by Edward Alsworth Ross, by permission of the Century Co.)

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an underground moisture in summer and a raging flood in the rainy season.

" With the woods vanishes much that makes life worth living. The brooks no longer run clear water filtered through moss and humus, but are turbid with the soil of the bared slopes. Fish will not live in them, and bathing ceases to be a joy. In twelve days of Shansi travel I never saw a boy disporting himself in water. The springs dry up and no late-summer pastures are freshened by the seepage from wooded hillsides. Dismally the muddy streams wander in the sun over wide shallows instead of lurking as of yore in deep channels under shading banks. No fallen tree or log jam checks the creek and offers an August lurking pool for the trout. No leafy path or mossy log invites lovers, though, to be sure, China does not believe in lovers. Millions live life through without knowing sylvan glades, ' green-robed senators of the mighty woods,' the glories of October leaves, or the boyhood pleasures of nutting, bird-nesting, and squirrel-hunting.

" Roots, twigs, grass, straw, and dung replace firewood. Brick or mud is the sole building

material. Brick benches and tables replace wooden furniture ; brick stoops, wooden porches ; and the highway stretches glaring hot and dusty to where the lone locust by the tea-house offers a patch of shade. Thus, with the woods vanish most of the sources of beauty, the founts of poetry and inspiration dry up, and life sinks to a dull, sordid round of food-getting and begetting."

SHANTUNG.

A large portion of the surface of Shantung is hilly, for the province rises like an island out of the Great Plain, but no forests exist ; the tale of denudation is the same here as elsewhere. Trees are indeed planted by the sides of streams and in places where they do not interfere with agriculture, but the hills are cultivated to the extreme limit of cultivable soil, and above this are barren and stony, while deep ravines are eaten out by the rains, and carry away their increasing increment of good soil. "The hill-sides and valleys are scored by innumerable steep ravines cut into fantastic shapes by the action of the rains—the shallow rivers bring down quan-

tities of sand and debris from the excoriated mountain-sides" (Kiaochow Customs Decennial Report, 1902). This has not always been the case, for Duhalde describes the mountains of Yenchowfu as covered with woods. In many of the fertile plains, as, e.g., from Laiyang to Kaomi, the country was described forty years ago as well wooded, with poplar, catalpa, sophora, ailanthus, etc.; and the Tsinan plain was thickly wooded for 150 miles, with groves interspersed among cultivated fields. But flood, famine, and reckless cutting have decreased the number of trees.

There are still, however, many fine orchard tracts in the province—of pear and apple, walnut and persimmon in the promontory, with red and black "dates" (*zizyphus*), especially west of Tsinan. Some "wax-trees" exist also, but the most valuable trees are the wild mulberry and oak plantations in the hills, where silkworms are raised. Unfortunately, the fruit trade has of late years greatly diminished, owing apparently to the deterioration of the trees. Experimental orchards at Weihaiwei have, however, been very successful. Stunted pines are, as usual, common

on the stony hillsides, being used to provide firewood. The cypress grows well in the carboniferous hills of Paoshan, and is highly valued for making coffins; at Kufow, the home of Confucius, noble groves of conifers (including the white pine) testify to the former beauty of the province when it was wooded.

Shantung is of especial interest because it is in the territories leased by foreign Powers that experimental forestry has been first undertaken in China. At Weihaiwei experimental planting was begun soon after the occupation; the raising of firs from seed failed, but seedlings from Japan (*Pinus thunbergii*) were imported and successfully grown, while among native trees the ailanthus and poplars, sterculia and gleditschia, and, especially near the sea, the tamarix are the hardiest. The locust (*Robinia pseudacacia*) has been very successful as a shade tree on roads both here and in the Japanese-leased territory in Manchuria.

But the great object-lesson to China is the afforestation scheme which has been brought to such success at Tsingtau, where the German Government commenced planting in 1899. The

task is a difficult one in Shantung, owing to the want of rain during the greater part of the year and the sterility of the rocky soil; but, thanks to the care lavished on the plantations, they have made satisfactory progress from the first. The trees planted were chiefly oak and Spanish chestnut among deciduous kinds, but the larger portion is coniferous. The contrast between the hills surrounding Tsingtau and the bare hills beyond is enough to convince the most sceptical of the value of careful forestry.

The fact that in 1909 the Chinese authorities at Tsinan set about making plantations is hopeful. Should these prove successful, the anxiety felt in Shantung for its supply of timber and fuel will be lessened, and the beginning of the solution of this difficult problem taken up.

SHENSI.

Shensi is divided into two very different regions: the northern portion, comprising two-thirds of the province, is cut off from the southern by the Tsingling, which separates the loess from the non-loess of the Han basin. The valley of the Yellow River is for the most part a dry and

barren area, but that of the Wei is very important agriculturally, and feeds the north-west. It is the seat of the old dynasties and the opening to Central Asia. This northern section is devoid of evergreen trees and shrubs, but the bamboo is cultivated in damp situations in the Wei valley. Here trees are scarce, but there is an admixture of those found in Chihli and those from more southerly parts of the Great Plain—the paulownia, ailanthus, catalpa, cedrela, varnish, etc., with the ubiquitous poplar and willow. So rare are trees of any size that the poles standing in front of yamens, or temples, are sometimes made of cast-iron. In the extreme north of the province desiccation has advanced very far, and the desert sands are encroaching in Yulin-fu; and farther south the hills are remarkably bare of vegetation, and jujube (Chinese date) plantations furnish the only trees. But south of Yenanfu there are several wooded areas, with very wild and uninhabited country, the woods being composed of pine, cypress, birch, poplar, etc. These areas seem to have returned to a state of nature during the Mohammedan rebellion, when whole districts were depopulated.

VIEW OF THE GREAT WALL IN N. SHENSI, SHOWING ENCROACHING SANDS.

(From "Through Shên-Kan," by courtesy of the authors, Messrs. Robert Sterling Clark and Arthur de C. Sowerby.)

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But the important forests of Shensi are in the southern area, where the Tsingling Mountains separate the Wei and Han basins. This range is a labyrinth of hills and lofty mountains, of which the largest peaks rise to 12,000 feet. They are very sparsely inhabited, with the exception of the Hanchung valley, which, cut off from the northerly winds, has a warm climate, approximating to that of Szechwan, where there is a plentiful growth of evergreens, of wild bamboo, palms, oranges, and mulberry-trees. The Han River is thus a limit for certain vegetation, as David shows—e.g. the large ash, liquidambar, and fortunea.

The Tsingling is still but little known, for there are but two important trade routes across the range. One of these, on the west, was traversed by Richthofen and David, and the other, on the east, by the Szchenyi expedition a generation ago; but of recent years both Colonel Manifold and Mr. Willis, of the Carnegie Research Expedition, have traversed the range in more central parts. Even in David's time—that is, 1871—the northern hills of the range in the Wei basin had been long deforested; there

were few trees and no large ones, those seen including the paulownia, catalpa, ailanthus, etc., of the north, together with more southerly trees. In the central region of the range David found pines, firs, birches, willows, replaced at 10,000 feet by rhododendron. He states that cutting had not long been going on, and was carried on by men from Szechwan, before whose advent the woods had been left alone. Among hard woods he noted oak and cedrela, but the trees which gave the timber to the cutters were the firs, of which there were three kinds.

The deforestation mentioned by David has been continued without intermission since he wrote. Mr. Willis, crossing the range in the centre, up the Black Water canyon, says : [1] " The heights had once been timbered—there was then cultivation even over 5,000 feet—but now the wealth has vanished with the utter destruction of the forest," and ruined villages attested to the damage done. The Tsingling is a broad, even-topped uplift, with a general altitude of 8,500 feet, though some peaks run to 10,000 or even 11,000 feet. From this main divide a subordinate development of lesser hills runs at right

[1] *Amer. Geo. Soc. Bulletin*, No. xxxviii.

angles, and the northward-flowing streams fall 6,000 feet in thirty miles, while those going southward fall a like distance in seventy miles. These steeper northern slopes have a cold winter, wet spring, and short summer, while the southern slopes lie in a mild, temperate climate and descend to a semi-tropical one. In the divide are extensive forests (says Willis) of pine, spruce, and hemlock, mingled curiously, even up to 7,000 feet, with bamboo thickets. Passing a region of lilac and rhododendron, rice-fields and palms are reached on the south at 3,500 feet. Manifold found the passage easy, crossing four belts in seven days, with some hills well covered with forests above, but denuded below, largely by fires. These fires, which do such irreparable damage, are also mentioned by David as of frequent occurrence farther west, beyond Hanchung. Here the forest differed in character, for oaks were the basis of the woods, and the well-known fungus is largely collected in this region of the Han basin for export to the east and south. Other trees are wild cherry (a good hardwood), chestnut, elm, birch, poplar, willow, varnish, with pine, but no cunninghamia. The

alder, not found on the north side of the range, begins here, and is common in W. Szechwan. The cutters are described as at work here, and there were few large trees, but farther west, in the Lanshan, the forests were much larger.

The southern side of the Han basin is shut in by the Hopa and Tapa Mountains, which, beginning with gentle and partially wooded hills, rise along the Szechwan border to a region probably of perpetual snow, with peaks approaching 12,000 feet in height. Between Hinganfu and Chengkow lie virgin forests never explored by man, where tigers abound. Another range of virgin peaks lies north of Hingan, where is the home of the black bear. In this corner of Shensi the larger timber adjoining the Han River and its larger tributaries has been destroyed long ago. Much good timber abounds on the mountains away from the rivers, but is of no value owing to the prohibitive cost of transport—the mountain owners will give it to any one (writes a correspondent) who will pay them for cutting and transporting it. Trees appear to flourish as soon as an altitude of 1,000 feet is reached, and thence to 5,000 feet is their

favourite altitude. At 6,000 feet and higher the ranges are very bare of wood or vegetation. Pines grow here close together, and other species are seldom seen mixed with them. Oaks, especially dwarf oaks, have the same characteristic, but many other varieties grow promiscuously together.

The Hingan district is the richest on the Han; wealthy squires replant the young pines for future sales systematically. Raft dealers buy a whole hillside of timber as it stands, employ their raftsmen to cut, carry, make rafts, and float the wood down the streams into the Han, and so down to the centres of population in N.W. Hupeh. Bamboo is another great export; scores of rafts are constantly passing down the river. A mountain-side with natural springs growing bamboos is a very wealthy investment. Among subsidiary products Hingan exports nearly all the tung-oil which goes down the Han, while varnish comes in considerable quantities from the back rivers, and there are also resin, gums, nutgalls, wax, fungus, medical herbs, and tons of grass for cordage, sandals, and cash strings exported. The forest men keep many

hives for honey. Animals abound too in the forests—tigers, leopards, wolves, foxes, bears, otters, badgers, etc.—whose skins are sought after, and ant-eaters, porcupines, and deer, the latter valuable for their horns.

Although pine, fir, elm, and poplar are the principal trees, there are also many fine varieties of rare hardwoods seen in the deep gullies and by the brooks in lonely mountains, and when the rains are more violent than usual these timbers become more accessible owing to the flooded condition of the streams, and are cheaper. The best known of these is the Tan, or Dalbergia, which fetches high prices. Some of the temples at Hingan have pillars six feet thick made of this wood, but this size is not found now, and better management of these fine trees would repay trouble.

The paulownia and catalpa are used in boat-building near the Hupeh border.

SZECHWAN.

Szechwan proper, the land of the Four Streams from which the province derives its name, comprises the eastern portion, a triangular area

named the Red Basin by Richthofen, from the red sandstone of which most of the surface is composed. This portion is densely populated and carefully cultivated, this cultivation not being confined to agriculture alone, but extending to the planting of useful and ornamental trees such as the bamboo, tung, mulberry, cypress, varnish, wax, and a variety of fruit-trees. The most important part of the Red Basin is the Chengtu plain, which has been described as the most densely populated area of the earth's surface. The vegetation is in most parts of the basin of almost tropical luxuriance owing to the extreme dampness of the climate, which permits, in the Chengtu plain, an admirable system of irrigation. Seen from a height, the plain looks like a forest, for every farm has its grove of bamboo, cypress, palms, and fruit orchards, while tung and varnish trees abound. The country along the Min and between Kiating and Chungking is also rich in trees, which are described as "of living green, free from insects, and without blight or deformity," thus rendering this part of Szechwan an object-lesson to regions farther east. Here the nan-mu is still cultivated in some

quantities, poplars and willows and the pterocarya shade the watercourses, pines and cypress and alders grow on the hills, and the cudrania, tallow, privet, and ash are used industrially, as well as several kinds of soap-trees. Among other trees furnishing timber are the dalbergia, several oaks, the chestnut, paulownia, melia, and sterculia.

The central portion of the Red Basin—the basin of the Kialing River where it runs through the plains—is a contrast to the west and south, for, as Lytton and other travellers tell us, there is not a tree worthy of the name between Hochow and Paoning. This region is poor and unproductive comparatively, and this circumstance is due to the diminution of the area available for rice-cultivation owing to the denudation of the hills. "The low sandstone hills being very friable and exposed to the action of the weather, a slight shower washes away quantities of soil, and irrigation on the upper slopes is impracticable. Rice is accordingly confined to the lower gullies, maize, millet, buckwheat, and sweet potatoes being grown on the upper slopes. The houses and market-places are very poor, and the soil is the worst in the province." [1] And

[1] Parliamentary Papers, 1898.

yet the population is swarming, so that famines are inevitable from time to time. The bed of the river is shallowed by the sandbanks formed by the washing away of the soil. This state of affairs can only be remedied by the reafforestation of the district.

South of the Red Basin the hills on the right bank of the Yangtze rise to a considerable height along the Kweichow boundary, and these rugged and broken ranges, though bare and rocky in many parts, have large forests in the more inaccessible heights. In the Jênhuai district and westwards fir and cypresses are cut and sent to the great timber mart at Luchow, but good hardwoods are found here also, including nan-mu, dalbergia, and the valuable hung-tou. Farther east the Kinshan hills—first traversed by Consul Parker, who has described this range in his admirable *Up the Yangtze*—is well wooded, and much oak is grown here, with cypresses and fir alternating, and bamboo, which seems to be universal.

In the north-east corner of Szechwan, where the province marches with Hupeh, is a wild mountain land, whose fastnesses are almost

virgin, where untouched coniferous forests exist, similar and indeed coterminous with those described in Hupeh. Colonel Manifold, who alone in the course of his unique survey work has visited these ranges, says that the gorges, where there is a sudden plunge of several thousands of feet to the Red Basin, are most magnificent, and far finer than those of the Yangtze. Altogether this watershed possesses some of the finest scenery to be found anywhere; to the south-west the lower hills are covered for miles with myriads of tung-trees. The most important river rising in these mountains is the Ku, which flows into the Kialing at Hochow. There is a considerable timber trade on the Ku, and Hochow is one of the largest junk-building centres in Szechwan. The wood chiefly used is cypress and oak, the latter for the bottom boards. The lower course of the Ku is quite treeless, but both on its upper waters and on those of its affluent, the Pashui, a good deal of timber is cut. The cypress mentioned is a white hardwood, which can still be obtained over 100 feet in length. At the waterside good logs can be bought for 1 to 2 Tls., but transport soon

doubles the cost, and there is much inaccessible timber away from main tracks. A good trade is also done at Suiting, the chief mart on the river, in skins and drugs. Forest fires are fortunately uncommon in this damp climate, but on the other hand little replanting is done. Wood is remarkably cheap and plentiful in East Szechwan, and this must be due to the fact that coal is so easily available in large quantities that the trees have been spared. The small range, some 3,000 feet high, which runs parallel with the Yangtze and between it and the Ku, is well wooded with fir, cypress, and other conifers, with a luxuriant undergrowth of fern, blackthorn, and small bamboo and grasses, and the scenery is of a savage grandeur even in these lesser hills.

The timber regions north of Chengkow, on the Shensi boundary, have already been described (vide Shensi). Farther westward the Hopa range continues to be no less wild and rugged a barrier between the two provinces. It is here an intricate and barren sea of mountains, which remains quite unexplored. Timber supplies come from this range southwards to the plains down the Pashui just mentioned, and down the Tung

River to Paoning, which centre is also supplied by the main branch of the Kialing from Shensi and Kansu. The wood on the Tung is the finer. On both these rivers the most common wood cut is cypress, but there are also some forests of fir and pine. The local woods near Paoning have almost entirely disappeared; in fact, the only remains of the old cypress forest near there is the fine avenue lining the post-road for a great distance, and preserved by official command. Even near the sources of the rivers in this part of Szechwan the forests are disappearing; the cypress logs available at Paoning are now of an average diameter of only from 8 to 12 inches, and a log of 40 feet in length and 1 ft. 3 in. diameter is considered a very good specimen. The cypress is used in building, as it is more durable than pine, which is used only for making furniture. There are, besides, some oak woods (not found south of Paoning), and silkworms have lately been reared on some of these. Other woods are camphor, ash, some fine walnut, sterculia, tung, a little nan-mu, and some hung-tou. In the lowlands of this region there are enormous quantities of mulberry, as it is an important silk

THE DISAPPEARING FORESTS.

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district. In fact, the only replanting of trees done is that of mulberry and tung, and the timber question may before long become acute here also.

The Central Asian plateau comes to an end in Western Szechwan, and the line of its precipitous heights marks the limits of the Red Basin, and the beginning of a totally different region. Here the advancing wave of Chinese civilization is gradually pushing back the old independent tribes, and this advance is marked by the destruction of forests along the borders. When travelling from Sungpan to Lunganfu forty years ago, Gill noticed the ruthless destruction of the forests and predicted that the hills would become bare like those of North Persia, whose bleakness had so impressed him. A more recent traveller, D'Ollone, when penetrating still farther into the wild regions at the headwaters of the Min, found evidences in these remote regions of the same destruction. He says: "Woods were plentiful; no one fells them, for the river is no longer navigable, and transport of timber impossible; and since the country is not frequented by shepherds or herdsmen, it is to no one's interest to destroy

the forests. We wondered why they did not cover more ground, and why they were not continuous, as they must have been at one time, for it is the nature of the forest to gain ground wherever man does not oppose it. The explanation was quickly furnished. We found whole forests laid low; a fire lit by some hunter or herbalist (men come from a great distance to gather medicinal plants from the Tibetan borderland), and imperfectly extinguished on breaking camp, had resulted in a forest fire, and the wind had uprooted the calcined trunks—a spectacle as tragic as a battlefield heaped with rifled bodies. Thus, through the negligence of man, the secular forests are disappearing, and at many points in these smiling valleys the waters ravage the slopes, where nothing is left to bind the earth and check the rain. In a few centuries they will be as scarred and bare as those we had traversed in China." [1]

THE TIBETAN BORDERLAND.

This "Tibetan borderland" includes nearly the whole of Western Szechwan, the north-

[1] *In Forbidden China*, p. 224.

western angle of Yunnan, and Eastern Tibet—the region which has for the past two years been a debateable land, where warfare has been waged between Chinese and Tibetans without any conclusive success. The northern portion of this area, a territory about 250 miles from north to south and 350 from east to west, is occupied by more or less independent tribes. This region is traversed by the Yalung and Tung Rivers in their upper courses, and the lofty ranges of which it is composed are mostly wooded with magnificent timber, although there is some pasture-land, and the grassy plateaux gradually assume the ascendancy towards the west. Most of this timber is useless, as the rivers, from their abrupt bends and enormous boulders, in addition to their turbulence, do not admit of being rafted down. But on the Min, which enters the Chengtu plain at Kuanhsien, a great deal of lumbering is done. When Gill ascended the river to Sungpan there was, especially on the upper waters, a considerable amount of forested land, but this has now almost disappeared, except on the mountain-tops. However, the numerous affluents of the Min are still able to supply a large timber trade. The

chief timber is spruce (two species), juniper, and pine. In the lower slopes the cunninghamia is the representative conifer, and of broad-leaved trees there are varnish and nutgall, producing rhus, box, wax-tree, and some gingko and nan-mu. Up the Min are some woods of ash and beech, and round the Chinese farms grow poplar, willow, walnut, and peach-trees. Rafting from Yinhsiuwan, the chief timber depot on the Min, is a dangerous enterprise. The rafts are made long and narrow, with the logs overlapping each other, and are fastened with bamboo-ropes. They are thus rendered firm but pliable. Great nerve is required to take them through the gorges to Kuanhsien, for the waves break completely over them, sometimes even breaking up the logs on the rocks. The work is considered so dangerous that the provision of coffins for the raftsmen is an item in every contract for labour supply.

This eastern border of the Central Asian plateau is a very damp region, as it intercepts the moisture of the monsoons of the China Sea. Thus here, as in southern Kansu, bamboos may be found growing almost to the snowline, and

the hemp-palm survives the cold at a considerable height. Conifers descend to 4,000 feet, but the snowline is lower than farther west, and the limit of conifers is stated to be 11,000 feet, the spruce not existing above 5,000 feet. As one goes westward the trees of higher altitudes appear —silver fir (with a range of from 8,000 to 10,000 feet), birch, prickly oak, and rhododendron just below the snowline. Mountain ash, maple, lime, etc., are other less frequently occurring trees. Magnificent specimens of arbor vitae are quite common between 8,000 and 12,000 feet, but forests of this tree are rare.

Besides the Min, two other rivers contribute a large amount of timber to the plains. These are the Ya and the Tung, which enter the Min at Kiating. The Ya rises in Muping principality, where the Abbé David studied the fauna and flora for many months. It flows past the sacred mountain of Omei, where the trackless forests begin. Here the woodmen are cutting ruthlessly, and up the Tung much wood has been cleared away up to the Tatsienlu region. On the Tatu River (as the Tung is named in its higher reaches) and its feeders are splendid forests,

whose immense trees resemble the giants of the British Columbian forests. Years ago an attempt was made to raft down the Tungling River, where these forests are at their best, but the rapids were too bad, and there was so much loss of life and timber that the enterprise was abandoned.

South of the Tung is the famous Kienchang valley, a low-lying tract colonized by Chinese in the midst of other races, and long since denuded. Here are the "wood-mines," a name given to the immense conifers which are found embedded in the soil on the hillsides. These trees are, when discovered, dug up and sawn and exported, as they have a very high value from their imperishability. Treeless also are the mountains east of Kienchang, the abode of the Lolos, or Nosu, who are a pastoral people, and therefore great destroyers of trees, burning the forest for pasture and to drive away wild beasts. Forests are found in few places in Babuland (another name for Nosu), what does exist consisting of pine, box, rhododendron, etc. From the south—on the Kinsha—the Nosus take coffin-boards for sale to the Chinese across the river.

They themselves practise cremation and do not need coffins.

West of a line drawn from Tatsienlu to the Kienchang valley is the great plateau, whose surface rarely falls below 10,000 feet; it is essentially a grazing country, but the tops of the ranges up to 14,000 feet are thickly clad with conifers—silver and Scotch fir, pine, larch, cypress, and juniper, with some beech and rhododendron. In the countless valleys and depressions with which the region is seamed are oak, birch, wild cherry, some maple and mountain ash, also poplar and horse-chestnut below 10,000 feet. M. Bacot has described, in *Le Tibet Révolté*, a typical descent from the grassy uplands to the valley of one of the rivers (the Yalung). "The forest began," he says, "at 13,500 feet. First there was the Alpine forest, with great straight sad pines, almost black. Then the true Tibetan forest of cedars, elegant and romantic, with a well-kept look like the Japanese forest, clothing the mountains like a bird's plumage. It is mysterious and tranquil, archaic, ideal like the forests of the old tapestries. It possesses the same intimate and charming

corners, with the dim, level, turfy clearings, the little conventional knolls piercing the foliage of the silvery oaks, and large, pure flowers and white pheasants." In its recesses are a treasure of wild strawberries, raspberries, cherries, peaches, gooseberries, and wild grapes. The black pines are replaced here by silvery firs. Where the valleys open out are cultivated spots, tended like gardens, with mulberries and poplars. Cultivation is carried to 13,000 feet.

This Tibetan tract extends southwards to 27° N., but the forest areas are as a rule far too remote to be of any real value save to the widely separated villages of the Tibetans. Even here the rude methods of transporting the logs, and the primitive saws in use, make timber expensive, and, as Bonvalot has remarked, the timber is generally, in the Tibetan sphere, the wealth of the grasping lamas. The houses are built mostly of stone, but sometimes, in the milder regions, with thin logs or wicker-work, covered with a thick layer of clay. For fuel argol, or cowdung, replaces firewood. Unfortunately, in the drier tract of S.E. Tibet forest fires are so frequent that whole mountain-sides are

PINE FOREST, LOCHWAN, SHENSI.

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laid bare. Mr. R. F. Johnston, when on his way south from Tatsienlu, remarked the extraordinary frequency of these fires along his whole route, many of which commence and burn themselves out in pathless regions. He suggests that the fires may owe their origin spontaneously to friction between the dry branches of adjoining trees which have been killed by the "fairies' scarf," a lichenous growth common throughout these forests. Forest fires appear to be infrequent in the damper region to the north-east, and are perhaps confined to the arid southerly tract. Mr. F. Kingdon Ward has recently visited the Tibetan borderland, and his description is worth reproducing here for the light shed by it on the conditions which give rise to forest fires. He says[1]: "The two great massifs (which lie to the west of the Mekong and Salween Rivers respectively just north of the 28th parallel N.) correspond in position to the line of junction between the rainy and arid regions of the valleys of the two rivers, so that it is evidently these and their northward extension which form the remarkable rain-screen whereby the Mekong-

[1] *Geog. Journal*, vol. xxxix.

Yangtze divide has its rainfall cut off and the snowline is suddenly elevated to something like 19,000 feet."

From the Yangtze plateau is a rapid transition to the valleys of the Mekong and Salween, and then, on the southern border of Tibet proper, the indeterminate frontier of the Himalayas and hot Asia is reached, where Alpine forests and gigantic canyons are left behind and a swift descent is made into a new vegetation, a region of creepers, palms, and dense jungle.

The enormous timber wealth of all this region is lying unused, and the question arises whether it can or will ever be tapped. Mr. J. H. Edgar, author of *The Tibetan Marches*, who is familiar with the whole region described, writes: "At present only around the mountains fringing the plains of W. China is advantage taken of the great timber wealth, and even there the output is barely sufficient for local requirements. As far as I can see, railways would not help very much, for when the more accessible forests would be cut out, as they would soon be, the problem of transport would again become acute, and probably railways would not enter the non-Chinese

forest-clad regions for many decades—if ever. The difficulties here mentioned in the Chengtu region apply also, not only to all feeders of the Yangtze, but on the Mekong and Salween. With timber, as with all else, from Tibet and the highlands between Tibet and China, railways in Yunnan will be more likely to tap their wealth." This is, then, a problem for future generations to solve. Perhaps the Chinese will, before the time comes when the problem is pressing, have learned wisdom from experience, and the great forests of the Tibetan borderland may be regarded as a valuable national storehouse, to be scientifically worked, while at the same time the splendid rivers may be harnessed and usefully employed for timber transportation.

The following extract from the Chungking British Consular Report for 1909 affords evidence that interest in Szechwan timber is at least showing signs of awakening: "In order to foster home industries, an endeavour is being made to procure sleepers from the Lolo Marches, near Leipoting. Samples of oak and chestnut were recently sent to the engineers of the Szechwan-Hankow Railway at Ichang, who reported

them superior, if anything, to the Japanese hardwoods. They would probably last fifteen to sixteen years when used as sleepers. An offer was made to pay $1.20 per piece delivered Ichang against $0.90 for foreign pinewood sleepers."

TURKESTAN.

South of the Altai is the depression of Dzungaria, with an average altitude of 1,500 feet. It is less arid than the deserts farther east; saxaul and tamarisk grow on the lowest parts, and scrub-oak and poplar forests on the rivers which flow north from the Tienshan. In the Baitik Mountains, an offshoot of the Altai on the north-east, are poplar and alder in the valley bottoms and larch above. These regions are the meeting-ground and limits of many floras, including (vide Appendix D *Unknown Mongolia*) the eastern range of many European and W. Asian species, the southern limit of many Siberian varieties, the northern range of some Chinese and Indian, as well as the entire range of a few species peculiar to this part of Asia. The mighty Tienshan range, extending from the Pamir to

the Gobi, is an isolated area in the midst of the Central Asian zone; its eastern extremity—the Karlik Tagh—containing, however, fine forests of Siberian larch as well as of the Tienshan fir, and constituting a very interesting neutral zone, which attracts a considerable rainfall, so that on its lower slopes towards Hami rose and willow thickets flourish under gigantic elms, poplars, and walnuts.

The Tienshan flora, once intermediate between the Altai and Alpine, has, by the advance of desiccation, become more Central Asian, and is lacking in variety.

The Tienshan is bare on its southerly slopes, but on the north is clothed with forests—of Picea schrenkiana, the Tienshan spruce, on the higher belts below the snowline and the Alpine meadows, and mountain ash, aspen, willow, etc., on the lower slopes. In some parts the juniper (*pseudo-sabina*) and birch exist. In the Ili valley the Chinese immigrants have planted groves of trees round every village, says Semenoff, and this is important as proving that artificial cultivation of trees is possible even in so dry a climate as Central Asia.

The plain of Turkestan south of the range is, except in the west, a desert fringed with small oases. In the west the irrigated region along the Tarim and other rivers is very fertile. This has been called the "apricot" zone, for large-stoned fruit-trees flourish. The shade trees are poplar and mulberry, and in the jungles skirting the rivers south and north of the Takla-makan desert willow and tamarisk are abundant, though the chief feature is the tograk (poplar) forests.

"An uninterrupted mountain wall stretches from the Upper Hwangho to the Pamir, dividing the great intumescence of Central Asia into two parts—the Mongolian desert on the north and the Tibetan plateau on the south. Nowhere in the world is there to be met with on such a scale so marked a difference between two countries lying side by side. The chain of mountains separating them is often not wider than about thirty miles, and yet on either side of it lie tracts completely distinct in their geological formation and topographical relief, in their elevation and climate, their flora and fauna, and, lastly, in the origin and fortunes of the peoples inhabiting them." [1]

[1] *Geog. Journal*, vol. i. p. 31.

General Description of Forests

North Tibet is a region of poor vegetation—no trees and but few bushes, of which the only erect-growing kind is a species of willow—but possessing grassy uplands, supporting a variety of herbivorous animals. Kozloff tells us [1] that in its eastern portion—that is, to the east of a diagonal line which runs south-east to north-west—the Tibetan plateau falls under the influence of the monsoons from the Indian Ocean, and is consequently rich in atmospheric precipitation, which feeds the rivers (the Yangtze, Yellow River, Mekong, etc.); but to the west of this line, where the plateau attains a still greater height and has a still more even surface, the dryness of the climate progressively increases, and instead of a covering of grass we find only a gravelly desert. As soon as the Yangtze basin is entered the climate is milder and pleasant landscapes are seen in the gorges, and in the valley of all the great rivers and their affluents in this region decreasing altitude is the signal for forests to spring into existence. On the upper slopes of the mountains, below the snowline, are the rhododendrons and junipers—bushes which at lower elevations develop into tall trees 70 feet

[1] *Geog. Journal*, vol. xix.

high, or of pine and fir, birch and holly-leaved oak, with an undergrowth of wild apple and apricot, honeysuckle, spiraea, and other wild flowers. Cereals are grown here to 12,000 feet.

YUNNAN.

The surface of Yunnan, which extends from the tropics to almost the thirtieth parallel of N. latitude, exhibits a great diversity of climate, but in general the province may be said to have dry and wet seasons, influenced by the north-east and south-west monsoons, the dry season extending from October to May. This rule is, however, modified in the west by the trend of ranges which run north and south in a gridiron formation. Thus in the south the Red River valley is in winter completely arid, as also the mountains which dominate it to a height of 3,000 feet, while the same ranges from 3,000 to 8,000 feet are thickly wooded and frequently enveloped in mists and rain, whereas northwards the rains are cut short in their easterly progress by the same ranges, and the region beyond is rendered very dry.

From the dense tropical jungle of the Chinese

Shan States it is an abrupt transition to the elevated plateau of central and eastern Yunnan, which extends into western Kweichow. This broken plateau rises to an average height of between five and six thousand feet; it falls away precipitously to the river valleys which define it. Many of the hills of which it is composed are clad only with grass and fern and present a bleak appearance, but others are covered with fir-woods. This portion of Yunnan has, however, been far better wooded in the past than now. The north-eastern projection of the province—Chaotung prefecture—was the last part of China to produce in large quantities and great size the famous nan-mu tree. But the bare surface of the hills there testifies to the tragedy of the reckless clearing of the timber. The Chinese traditions are that once all this country was forest-clad. Now, indeed, it would be left quite treeless but for two reasons: firstly, that the landlords are largely Nosu—i.e. aborigines called by the Chinese "Lolo"—who always build their houses at the foot of a small wooded hill if possible, thus obtaining a picturesque setting for them—any vassal who dared to cut down one

of these trees would be severely punished; secondly, the Nosu graves are surrounded by trees.

The great French explorer Garnier notes how the hydrography of this region (especially the Takuan district) had been completely transformed by deforestation. "Old men affirmed that in 1790 the River Ko-kwei was crossed dry-shod from stone to stone here where it is now not fordable; and much lower down men of fifty remembered having heard their grandfathers say that the stream was forded at Tungkokai, and that trees grew on its banks, where none are now seen and where the river is now twenty feet in depth." [1]

But where the land is Chinese even the trees that remain are being rapidly cut down for building and to supply the needs of a Government match factory. Of trees other than the fir and pine, oaks grow in some quantities, but mostly not over 20 feet in height, for they are cut for pillars or charcoal; walnuts are allowed to attain great size, as they are valued for heavy furniture; chestnuts abound; willows are planted

[1] *Voyage d'Exploration en Indo-Chine*, etc., p. 534.

along streams. In the warmer districts the tung-tree grows in great profusion, and is likely to be more widely planted in view of the increased demand, as is also the varnish-tree, which grows at higher altitudes. The wax-tree (privet) grows widely in this part of Yunnan. The ash is prized for making furniture, and is one of the few trees allowed to grow to some age. The dearth of trees alluded to is not so noticeable at some distance from high-roads, and here and there efforts are being made to plant trees, which, in the opinion of a foreign resident who is an authority on the district, will eventually be crowned with success. But the work to be done is enormous.

The same remark applies over a large part of the plateau. A British Consular Report from Mengtsz, in the south, has the following remarks: "A Department of Agriculture is needed. The climate is especially suitable for fruit-growing —both temperate and tropical kinds—pear, apple, cherry, plum, apricot, peach, walnut, chestnut, persimmon, grape, all grow (that is, near and south of Yunnanfu). A good plan would be to start experimental orchards at the railway-stations (on the French line). Match factories

have not yet been started (in 1906). But near the marts the environs have been denuded of fir-trees. The bane of Yunnan is the insouciance with which the ruthless destruction of timber is regarded. A traveller across the province who finds himself in a well-wooded district may be certain that he is several hours, perhaps a day or more, distant from an administrative centre, for otherwise no trees, or few, would be left. The result of this destruction is that the hillsides are washed bare of earth, each heavy rainfall becoming a disastrous flood, and the springs formerly fed by the forest gradually dwindle until they disappear. The officials are not ignorant of these truisms, and from time to time put out posters exhorting the people to plant pines and firs and to abstain from setting fire to the hillsides. Seeds even are offered gratuitously. But surveillance is wanting that alone would prevent the peasant from helping himself to any firewood that comes handy, as no self-respecting mandarin would leave his chair on the high-road. If left alone, this region might become the Switzerland of China."

A similar report for Tengyueh, in 1908, says

EFFECTS OF DEFORESTATION, WEICHANG, CHIHLI.

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that the officials have realized the advantage of reafforesting the mountain-sides, and a number of the heights surrounding the larger valleys have been planted with pines and firs. Fruit should flourish there too, as 60 inches is the annual rainfall, confined to four summer months, and the dry winter would be very favourable.

A great contrast to the bare portions of the plateau is presented on the south and west. Along the Tongking frontier is a little-known region of broken hills, covered both in Yunnan and on the Tongking side with forests, which have not yet been exploited and are probably rich in valuable trees.

Farther west the land rises gradually from the lowlands of Siam to the Shan States, where the climate is far cooler and more invigorating. The zone of teak does not extend beyond the limit of the Menam watershed, for on the Mekong slope it grows only in small quantities and is stunted, and in the Chinese Shan States it seems to be of rare occurrence, though in the south of the British Shan States (Kengtung) it is abundant, as also in the French Laos. Rich forests stretch from the Salween to the Red River, across

the country south of Yunnan, but the Chinese Shan States are held to be the richest territory north of Indo-China. Even before Siamese soil is left pines are found on the higher summits, and tropical products such as gambier and areca become rare. The Chinese Shan States are a region of confused hills, with narrow valleys widening here and there into fertile plains where rice is cultivated. The mountains, varying from 4,500 to 6,000 feet in height, are for the most part covered with dense forests, which are rich in species of both tropical and more temperate zone plants. On the heights pine, oak, and chestnut woods grow together, and in the torrent-beds is a vegetation of creepers, rare orchids, banyans, palms, bamboos, etc., and wild beasts swarm. In order to drive these out and to make clearings for cultivation, the Shans periodically burn the jungle, and in the dry season the landscape is obscured by the haze from hundreds of fires, which do an immense amount of damage. In a recent work on the British Shan States [1] the authors say: "There is no primeval forest: a few trees, such as rubber, teak, oak, and chestnut,

[1] *The Shans at Home*, by Milne and Cochrane.

are long lived ; many that are soft-wooded grow rapidly and soon become covered with a thick growth of ferns and lichen, under whose shelter many insects live and bore into the trees. The creepers crush them, ' white ants ' come in armies to any rotten wood, the first wind blows them down, when others arise for a short life." This description may be taken to apply to the lower and damper tracts.

The most destructive influence to the forests is the tendency of the Chinese to encroach on the land of the aborigines, for where this occurs the woods are granted short shrift. Already between Szemao, the Chinese centre, and Mengli the mountains have been denuded of timber by forest fires, the destruction being partly wanton and partly carried out as a measure against tigers and panthers. Were these denuded hills suitable for agriculture this destruction would be of less consequence, but as it is they are laid waste and put to no use ; it has, indeed, been suggested that they might be devoted to cattle-breeding, as on the foothills of the Rockies, but no market exists for beef. Here, again, the wanton devastation should be arrested before it is too late.

The flora of these forests is extremely rich and varied, but has not yet been thoroughly investigated. That of the Bavi district, in French Laos near by, which if not identical must be very similar, has been called one of the richest flora in the world.[1] From this frontier region timber is hauled to the Black River, but the methods of lumbering are very destructive—trees are cut at five feet from the ground, the tops and branches are abandoned, and, in order to clear a path for haulage, hundreds of young trees are cut away and wasted. These methods should be prevented if the forests in Chinese territory are ever exploited for timber—an eventuality which seems very far in the future at present, but which future generations may yet witness when this part of the world becomes opened up. Here is a wealth of hardwoods similar to those of Burma and Upper Tongking, together with a great variety of tropical economic shrubs, awaiting development.

From Szemao north-westwards the Salween and Mekong basins constitute a somewhat similar

[1] Vide "The Black River of Upper Tonquin" in the *China Review*, vol. xix., by M. Dumoutier.

region, but the country continues to rise uniformly, and although the river valleys are still almost tropical, the mountains are often covered with pine and fir forests; and increasingly so on the upper courses of the Black and Red Rivers, where less of the precipitation from the Indian monsoons is received. Among broad-leaved trees the oak, ash, elm, and birch are found, with undergrowth of laurel, azalea, etc. The aborigines who inhabit these hills depend largely for their living on the firewood which they cut and carry to the scattered plains, which are frequent towards the plateau on the east, and have been occupied by the Chinese. Yunnan retains its reputation as a fruit country along the Burmese frontier no less than on the higher plateau, for in the Shan territory and that of the other aboriginal tribes every village has its groves of pomegranates, bananas, guavas, and oranges, and northwards are found peach, pear, plum, and apricot-trees, and in the higher woods wild apple, cherry, and peach-trees abound.

Very little of the timber of these regions is available owing to the nature of the country,

where the rivers have cut deep trenches which isolate their basins from each other and from the plateau land. As the outlying spurs of the Himalayan tableland are approached, however, some advantage is taken of the timber wealth. Indeed, the hills near Yungchang and other Chinese centres have been quite denuded. The same fate long ago overtook the Talifu hills, but west of this fine conifer forests exist, affording a striking contrast to the eastern slopes. The frightful slaughter during the Mohammedan rebellion checked the destruction of timber, from the simple fact that none were left to cut it, and much land reverted to Nature.

But as soon as the Chinese-inhabited country is left, the wooded regions are once more gained. Leaving the pine forests, a new flora is once more found in the steep river valleys—the sunless depth of the tropical forest in wild Lisu-land, on whose borders the Chinese are pressing. From the mountain-sides above 7,000 feet timber is cut and a thriving trade in coffin-boards done by the more civilized tribes with the Chinese, who also buy musk, gold, bears' galls, and other forest produce valued for drugs. The

varnish-tree is a somewhat unexpected plant in these regions, but it forms another article of the sparse commerce of this locality. Here the Salween and Mekong draw close together, and the narrow ranges grow correspondingly lofty, forming, just north of the 28th parallel, the rain-screen which receives the precipitation of the south-westerly monsoons, and brings the tropical vegetation to an end.

SECTION III

THE FOREST PROBLEM

In recent years China has felt the first stirrings of the progressive spirit, and the Government has recognized that forestry is of prime importance, as evidenced by the attention paid to its development by the most advanced nations. The first step taken in China was the establishment of a forest school at Mukden, in Manchuria, in 1907, and although the stress of political events has tended to overshadow work of this nature, at least the germs of future development have been laid, and with the establishment of settled government, it is to be expected that work of this nature will make a steady advance. A foreign adviser to the Bureau of Forestry at Peking was appointed in 1913, so that the interest of the Central Government is thus evidenced in the subject of so great import. It

is, indeed, high time that the matter were taken in hand, and some authorities even doubt whether it is not now too late to effectually remedy the damage that has been done by forest waste. An American forester writes: "On the waste hills of eastern China the rains rush off from the barren surfaces, flooding the valleys, ruining the fields, and destroying towns and villages. No water is retained at the higher levels, so that none is fed underground to the lower soils or to the springs. As a result, even on the plains the water level is too far beneath the surface to be used. Without irrigation and the ingenious terracing of hillsides, by which the rains are made to wash the soil into thousands of miniature fields whose edges are propped up by walls, agriculture would be entirely impossible. Even irrigation calls for the immense labour of drawing the needed water from wells." [1]

In order to set about the remedying of this state of affairs it is necessary to examine what has been done by other nations, so that their example may be followed so far as the conditions in China allow of advantage being taken of it.

[1] T. Cleveland: U.S.A. Forest Circular, 140.

The same writer states that the great achievement of French forestry has been the establishment of protective forests where much destruction had been caused by floods and winds. Encouraged by wise laws, the State, the communes, and private landowners have restored to forest over 2,500,000 acres, which now, in addition to being saved from ruin, return an excellent revenue. In 1860 the devastation caused by mountain torrents whose headwaters had been stripped bare of wood was so great that the State took steps to reafforest, but, by causing the burden of expense to fall on the mountaineers, caused great discontent. But in 1882 a law was passed providing that the State should bear the cost of planting, and since then the excellent results of planting have caused a revulsion of feeling, and the people are now only too eager to assist the work. It is expected that £10,000,000 will have been spent before the work of reforesting for protection is complete.

Then in regard to the shifting sands of the coast, which were gradually covering large areas of agricultural land, a very complete victory has been won in France. The sands have now been

BARING OF HILL-SIDES BY DEFORESTATION.

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largely fixed in place by forest plantations, which were begun in 1793. Here £540,000 were spent, but the State, which owns about half of the forest which was reclaimed, has recovered all its expenses, and now has a property worth £2,000,000. In the Landes 2,000,000 acres have been reclaimed from the sands and are now worth £20,000,000, after half a century of work. In other districts—as La Sologne, where old abandoned forests were revived, and Champagne, where arid limestone wastes have been partly reclaimed by replanting—the same results have been obtained, whether by private or public initiative, but always, in any case, under State encouragement.

The object-lesson furnished by France is of great value to China; but it is necessary to realize that such results can only be accomplished by perseverance over a long period of years and by the State, either directly or through aid given to communes, etc. It is interesting, in this connection, to observe the shares of forest land owned by the State in the leading forest countries.

It will be seen from the table on page 178 that in many of the important timber-producing

Country.	State-owned.	Crown-owned.	Owned by Communes.	Private.	Ecclesiastical.	Total Area.
Finland	Per cent. 80–90	Per cent. —	Per cent. —	Per cent. —	Per cent. —	Per cent. 63
Russia... ...	65·7	—	—	—	—	42
Japan	56·8	9·1	7·5	25·9	0·7	59
Sweden	33·2	—	—	—	—	35–50
India	83·0	—	—	—	—	24
Germany	31·9	1·8	16·1	48·1	—	26
France	11·5	—	—	—	—	16
Austria	7·0	—	35·0	58·0	—	33
Hungary	16·0	—	—	76·5	7·5	35
Denmark	23·0	—	—	—	—	—
Norway	10·0	—	—	—	—	25

countries the forests are largely owned by the State or by communes, and not left to be exploited by individuals, who care little for the welfare of future generations. The lesson to China is very plain, and some account of the forest policy of some of her neighbours who have taken up the question may be advantageously given. The Report of the British Royal Commission on Afforestation [1] contains the following summary of the reasons why afforestation should be a task for the State: "A forest crop differs in many respects from an agricultural crop, and chiefly in this, that it takes a much longer period to attain maturity. The success of afforestry depends to a large extent on a well-thought-out scheme of operations, with continuity of management throughout the whole period of the rotation. On private property such persistence is difficult to secure . . . [but] the State never dies, so that a scheme of operations can be inaugurated with every prospect of being carried out to a successful conclusion. In other respects, too, the State can accomplish much that is beyond the power of the individual. How-

[1] Part LV. p. 33.

ever convinced a private owner may be of the superior advantages offered by forestry as a means of utilizing poor land, he is confronted by many deterrent considerations. In converting pastoral land into forests, the present returns must be sacrificed, and even if these be small they possess the attraction of being tangible and immediate. But this is not all. To create forests requires capital, and even if this is forthcoming, its investment in tree-planting must mean the disappearance of any immediate return, and probably of any return whatever during the owner's lifetime. . . . Where, as in the case of forestry, a single commodity is produced, whose sale is so simple as almost to be accomplished automatically, the State has proved itself an excellent administrator."

INDIA.

In British India the forest policy of the Government has been very energetic and successful, and, owing to certain similarities in the conditions, such as the large areas dealt with, the problems of waste and erosion, etc., merits the attention of China's rulers. The destruction of

forests had proceeded to an alarming extent when the Government took up the question of forest conservancy sixty years ago, but at the present date an area equal to 24 per cent. of the total area of the country has been placed under the management of the Forest Department. In Burma this was not done without a severe struggle against the merchant class, who wished to have a free hand to exploit the valuable teak forests, which were, however, preserved from their rapacity. The first forest law was passed in 1865, and "empowered the several local Governments to declare certain areas 'State forests' without in any way interfering with the rights of the people." But owing to the friction which arose, a new Act was passed in 1878, the main provisions of which were as follows :—

"(1) Power to declare Government lands to be reserved State forests. (2) Power to demarcate these and to settle rights over them ; to commute such rights whenever they prevented conservation ; and to prevent new rights springing up except by Government grant. (3) Power to provide for protection and management. (4)

Power to protect forest produce in transit. (5) Power of punishment for offences. This Forest Act is not obligatory on the local Governments, which can apply it to any particular district as they see fit."

The results of the policy have been eminently successful; the area of reserved forests is growing, an efficient staff now numbering 11,000 has been trained; protection against fire has been assured over 36 per cent. of the area of reserved forests; an economic system of utilizing the produce of the forests has been introduced; planting of "protection forests" is carried out; and all this has been brought about without interfering with the rights of the people, who, moreover, receive much produce either free or at nominal rates, so that the importance of forest preservation is now recognized in many parts of the country by the people themselves.

In the British possessions in Malaysia the example set by India has been followed, and in this case forest conservancy has been taken in hand before difficulties have arisen.

PHILIPPINE ISLANDS.

Until recently the destruction of forests in these islands had been at a rapid rate, but the American Government has taken measures which have put a stop to this wastage. Close restriction of cutting is carried out in some districts, and entire prohibition in others, for a number of years. Licences to cut for twenty years have in some cases been granted to lumber companies, but only on condition that replanting is done and that native collectors of minor forest produce are paid fair rates by the licencees. In some forests licence to cut only matchwood and not the more valuable hardwoods is granted. In others, which have suffered severely from overcutting, the entire area is divided into "communal forests," one assigned to each of the neighbouring towns. It is believed that these towns will appreciate more than in the past the importance of caring for the forest tracts, and will be on the alert to prevent depredations on them by people of other towns.

In connection with education, an interesting feature is the provision of a number of scholar-

ships to be held at the Government Forestry School, thus assuring the attraction of talent to the service. Forest museums have been established to assist the spread of knowledge of the forests and timbers among the people, and a travelling exhibit has been prepared for use at the provincial fairs and exhibitions.

JAPAN.

The administration of forest lands, which cover 60 per cent. of the area of Japan, is of great importance, and of particular interest to China on account of certain similarities in the conditions. The forests are divided into five classes :—

1. State forests, owned by the Central Government and under the control of the Department of Agriculture and Commerce.

2. Crown forests, owned by the Imperial Family and under the control of the Household Department.

3. Public forests, belonging to the different Prefectural Governments, towns, or villages, and under their control.

4. Temple and shrine forests, belonging to

either the Buddhist or Shinto bodies, and governed by them.

5. Private forests owned by individuals.

Of the total acreage of 60,617,000 acres in Japan, almost exactly half is State land, while about $5\frac{1}{2}$ million acres are Crown lands, $8\frac{1}{3}$ public, $16\frac{1}{4}$ private, and only 300,000 acres belong to the temples.

The *Forestry Bureau* of the Department of Agriculture has entire control of the State forests. It is divided into five sections and one experimental station, and has ten major forest offices in the southern islands, besides a separate system in the large forest area of Hokkaido. Under these major offices are 211 minor offices and over 1,300 protection stations. An interesting feature is the "Sharing Forests," which are planted by private individuals on State lands, and the income shared between the State and the planter. The Crown forests are quite independent of the State Department, and the public forests are administered by the local body to which they belong, under the direct control of the Prefectural Governor. Temple forests are governed by the head-priests concerned.

State Forest Laws.—There are two bodies of legislation relating to the forests: (1) the State Forest and Plains Law, which legislates against danger and injury to the forests and for their utilization, and regulates such matters as boundaries, sales by tender of timber, and renting of State forests; (2) the Forestry Law, 1899, regulating the management of forests, providing for their supervision, preservation, expropriation of land where necessary, forest guilds, policing, etc. The laws are enforced by the Department of Agriculture and Commerce, using the national police force. In the Hokkaido, Formosa, and Sakhalin the Governors have entire control of the forests. The local Forest Council, consisting of officials and forest and engineering or mining experts, is also vested with authority.

Compulsory Preservation.—This is ensured by the local Governors compelling private or communal owners to protect lands against erosion, drifting sands, storms and tides, landslides; to preserve the headwaters of rivers, fisheries, to safeguard navigation, public health, and preserve beautiful scenery or celebrated places.

Appropriation by the State is set in motion

by a resolution of the Forest Council. If no cutting is allowed, the owner is indemnified, while in only partially reserved lands this is not the case. Even in unreserved forests the State can put a limit on cutting. Certain lands called "genya" have also been set aside for afforestation.

In general, attention may be said to have been paid to forest protection in Japan for several centuries, and for a long period restrictions on felling have existed. In modern times, as a preliminary to the organization of the forest service, a thorough investigation into the actual condition of the forests, and a survey thereof, was undertaken. Thus disputes as to boundaries are avoided, and the limits of private lands fixed and despoliation of forest products rectified. Working plans for all the State forests were then drawn up, and these have since been revised as necessary.

System of Forest Schools.—The training of forest experts has been carefully provided for, there being: (*a*) Agricultural and Dendrological Schools, where the elements of forestry are taught; (*b*) Forestry Schools (similar to the

Middle Schools), nineteen in number, after which the student proceeds to the High Agricultural and Dendrological School with a three years' course, and subsequently to either of the two Universities where the science of forestry is taught. In addition to these higher ranks the forest rangers are recruited from civil servants who have passed a special course, from ex-policemen, non-commissioned army officers, school teachers, etc.

Reafforestation is carried out to a considerable extent both by the State foresters and by the encouragement of private and communal planting. Subsidies are granted to the Prefectural Governments for planting useful timber-trees, and seedlings raised at the prefectural Government nurseries are distributed to the people either free of charge or at a low price. Experts give advice in connection with planting.

A few further points are of interest owing to similarity of conditions in China. In Sakhalin, where the fisheries are important, forests along the coast which have connection with attracting fish are carefully preserved. Near the coal-mining districts forests are reserved for the

supply of timber for mining purposes. In Formosa special attention is paid to encouraging the development of the camphor industry by distributing seedlings, by granting free leases of land for plantations, etc.

SIAM.

Organized forestry in Siam commenced in 1896, when an official, lent by the Indian Government, was appointed to take charge of the forests. Attention was at once directed to the valuable teak forests, the property of the Government, and the following measures were taken :—

1. A Forest Department was established with a European staff of officers, one of whose chief duties was to train Siamese youths for the service.

2. Royal decrees were issued providing for the better protection and control of the forests, and prohibiting any work except under lease. Hitherto the conditions of lease (containing conditions as to minimum girth to be cut, etc.) had not been enforced, in the absence of responsible officials, and many unleased forests had been

worked ; but this state of affairs and the resultant waste was now put an end to.

3. A survey was made of all leased forests with a view to ascertaining their future possibilities. Periodical inspection was ordered to ensure strict observance of conditions of leases.

4. Selected Siamese were sent to the Indian Forest School at Dehra Dun for training.

Further restrictions introduced in later years have included the raising of the minimum girth from 51 to 76½ inches, and the provision, under a new form of lease, for the closing of one-half of the original areas and the prohibition of further girdling of teak by lessees. The royalty has also been raised from 4.25 Rs. a log to 10 Rs. per large and 6 Rs. per small log.

The inauguration of this system was rendered necessary by the fact that in the north many hills which were once covered with teak are now, owing to the indiscriminate felling of timber, covered only with worthless jungle. Through the centre of Upper Siam runs a broad belt of country, the natural features of which have been entirely altered by the decrease of rainfall, and the evergreen forests have been replaced by

deciduous trees. The vast, almost untouched forests of the south will now, however, be saved, and this great source of wealth—for they are rich in many valuable woods—preserved for the country.

RUSSIAN TURKESTAN.

In this region of Central Asia the supply of timber is quite inadequate for the demands of the growing population, owing to the reckless cutting of the forests and the practical extermination of even the useful saxaul. What has been done here since the Russian occupation is of particular interest to China, in view of the growing similarity in the conditions in Russian Turkestan and North China near the Gobi. Up to 1879 such forests as did exist were cut without interference, but from 1880 the planting of forest trees by the authorities has been carried on systematically, and a check has at the same time been placed on the cutting of trees for firewood. Recent visitors to this country testify to the remarkable work done. Mr. W. E. Curtis, in his *Turkestan, the Heart of Asia* (p. 286), says: "Taskend, the capital, is one great grove, which

has sprung up from seeds and seedlings planted by the Russians within the last forty-five years (1911). The growth is extraordinary. There are acres of full-sized oaks, walnuts, elms, lindens, ash, maples, horse-chestnuts, mulberries, etc. It is asserted that more than 60,000,000 trees have been planted upon the deserts of Central Asia since the first occupation in 1868." And again (p. 66): "The Government has planted more than 3,000,000 trees in the Merv oasis, mostly poplars, mulberries, and locusts. The mulberries feed the silkworms, the poplars make roof-poles, and the locusts perfume the atmosphere." Page 336: "If the Russian Government had done nothing else for the country than plant the trees that have been set out since the conquest, it would be entitled to rank as a public benefactor. Millions of seedlings have been set out around the different cities, and along the river bottom and irrigating ditches, and no one can tell how many millions more have grown from the seed." Mr. Curtis, however, states that he had been unable to find anyone willing to assert that this forestation has had a beneficial effect upon the climate or the rainfall,

REMNANT WOODS NEAR YENANFU, SHENSI.

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though the trees are promoters of health and comfort.

At Margelan malaria has been stamped out by the planting of groves between the city and neighbouring swamps, mosquitoes being thus prevented from gaining access to their human victims.

In connection with afforestation in North China, the following remarks are of interest, from the report on Weihaiwei by Mr. S. T. Dunn, Director of the Botanical Gardens, Hongkong: "In parts of China where timber-growing is undertaken by private landowners money is often wasted through cutting immature trees to meet some financial emergency. The Chinese readily understand that one pine-tree grown for twenty years is worth much more than two grown for ten years, and if some system could be introduced to enable them to tide over the bad year they would gladly make use of it. The purchase by the Government of immature trees would in certain cases be a good investment. Sale in this way at the current prices of felled timber might perhaps be made obligatory with benefit, but it must in that case be remembered that the seller

should receive compensation for the loss of his land for replanting purposes during the time that elapses up to the year in which the trees reach their optimum value. On the other hand, the felling of trees for the proper thinning of the plantation should be encouraged, the selected remainder only being protected. When trees become Government property, the village elders should be made responsible for their protection from fire and theft. It would be beneficial, not only to future afforestation but to agriculture, if the practice of scraping bare even of grass on waste lands were stopped so as to allow of the recuperation of the land, while inflicting no hardship on the people. In any case the authorities should prevent the pulling up of grass and ferns by the roots, and the digging up of living stumps of wild shrubs and trees." In Hongkong a scheme was initiated in 1904 of issuing forestry licences in the hope of inducing the Chinese to adopt more economical methods in dealing with the considerable pine plantations on the mainland, and with the object of tempting them to take up fresh areas of waste land for further planting. This scheme seems to have suited the

Chinese, as there were only a few breaches of the rule, dealt with by withdrawal of licence.

The study of the development of forestry in these countries will be of advantage to China, and many lessons may be learnt from their experience—what dangers are to be avoided, what special points are worth imitation or adaptation to suit the varied conditions prevailing in the republic. The principle that the State can best manage forests and must have control, for the benefit of the community, of "protection" forests seems hardly disputable. In India, where difficulties greater than any likely to be met with in China exist, this question of State control has been solved to the satisfaction of all; in Germany the methods of securing the maximum profit obtainable from timber may be studied; and the wonderful results shown at Tsingtao form an object-lesson very near at hand. The issue of licences to cut is practised in several Oriental countries, and should be of great value as a means of controlling excessive deforestation; the extensive replanting in Russian Turkestan shows what may be done in the dry northern provinces of China. Perhaps most important of all is the

spread of knowledge about forestry and its benefits among the people at large—a system of lantern lectures would be of great value, while special education of forestry staff may be studied in many lands.

The Government has also recently constituted the Kirin Timber Bureau as chief office for the control of timber-working in Manchuria, a step which has great possibilities. In this connection the remarks of a writer in a Shanghai paper [1] are significant: "Kirin province is very rich in timber lands, and during the past decades many concessions [to cut] have been given out to Chinese, who as a rule do not do any felling, as it costs a considerable sum to work a timber concession. Enterprising individuals or companies are not found every day. It is of interest to note that a British company operating in the Priamur has come to an agreement with the Chinese concessionaires of timber lands situated near Hailin, and will start immediately to cut wood and ship by rail to Vladivostok, where it will be exported. Other enterprising foreigners are trying to interest European and American

[1] *The North China Herald*, February 28, 1914.

capital to exploit similar undertakings. If the Chinese are reasonable in their demands, and the Chinese Government gives proper encouragement and protection to all interested parties, there is no reason why a large industry should not be built up in this province, where there are many thousands of miles of excellent timber suitable for all purposes." It is indeed very desirable to make use of and develop the resources of these forests, which are a most valuable asset to China; but their very value itself makes it all the more important that the Government should safeguard them from the ruthless destruction which is inevitably associated with private enterprise where timber is concerned, and which has, for instance, in the United States, led to an almost alarming condition of affairs. It would be well for the authorities to study the reports of the American Bureau of Forestry on this subject before granting timber concessions, so that "replanting" clauses and general restrictions favouring forest protection may be inserted in any agreements which may be made.

The following presidential mandate is worth

quoting, as it shows that a beginning is being made in afforestation enterprise, and that encouragement from the highest quarters will not be wanting. The mandate bears date January 20, 1914, and is as follows: "Chang Chien, Minister of Agriculture and Commerce, reports the good work done by Yang, promoter and manager of the Tali Rubber Company of Nanyang, and by Liu, a citizen of Kanhsien, in Kiangsi, in converting mountainous tracts into timber woodlands. The former has achieved much in supplanting the foreign stuff, thereby stopping some leakage of money; while the latter, having himself devoted many years untiringly to the laborious work of afforestation, has been persuading the population to start similar plantation ventures on fresh grounds. In recognition for the encouragement of these industrious men, the fourth class Chiaho Decoration is given to them."

PART II

NOTES ON CHINESE FOREST TREES

INTRODUCTORY

THE flora of China is the richest temperate flora in the world, and is particularly interesting because half the species known are peculiar to the country. This wealth is due partly to the great extent of the land and to the climatic conditions favourable to the development of a variety of vegetation; but also to the fact that the south and west—the richest regions—contain lofty ranges of great length, whose altitude in comparatively low latitudes favours variety, while, in addition, there is an intricate system of minor ranges, where thousands of narrow valleys (in the words of Dr. Augustine Henry) form isolated areas where peculiar species have been evolved. A clear idea of the botanical regimes is given by dividing this part of China into altitudinal zones, and Mr. Wilson distinguishes five of these below 16,000 feet—the limit of vegetation in

Long. 102°, Lat. 30°. These are: (1) the warm-temperate zone, which extends to 2,000 feet—this is the cultivated belt, forestless; (2) the temperate zone, 2,000-5,000 feet, with damp forests of evergreens, chiefly oaks, the laurel tribe, and monotypic genera; (3) the cool-temperate zone, 5-10,000 feet, with mixed deciduous trees and conifers; (4) the sub-Alpine zone, 10-11,500 feet, where the forests are almost exclusively coniferous; and (5) the Alpine zone, with rhododendron, prickly oak, and dwarf juniper.

ON THE EDGE OF THE FOREST IN WESTERN CHINA.

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SECTION I

BROAD-LEAVED TREES

ACANTHOPANAX RICINIFOLIUM, S. and Z.
Chinese Name—Tzu Chiu.

LARGE leaf like that of castor-oil plant. Thorny. Grows scattered in Yalu forests, but does not form woods of itself. A fine tree, 60 feet high by 3 feet diameter. The wood is fairly hard, has a fine grain and gloss, and is sometimes used as imitation keaki (zelkowa) in Japan. Uses: spear handles, tools, trays, etc., and the bottom boards of boats on the Yalu are made from it. The South Manchurian Railway have furnished railway coaches with it, and it would be useful for sleepers, if not too scarce. Boards 55 feet long are obtainable, and the Chinese transport it by road from interior districts remote from the river to the populous districts. Price: Tls.3 to 4 per 10 cubic feet.

AILANTHUS GLANDULOSA, Desf.
Chinese Name—Chou Chun.

This is the stinking chun, which resembles in appearance the fragrant chun or cedrela. It is mentioned in the ancient book, the *Yu Kung*, as being included in the tribute from the State of Kingchow, on the middle Yangtze. The tree has a wide range, but is not found in South China. It was introduced to Europe in 1751 by the Jesuit D'Incarville. The wood is brittle, and of little value, being used only for fuel, though it occasionally seems to have been found suitable for cabinet-work and for musical instruments.[1] The Chinese gather the leaves in spring and pickle them with salt as a palatable vegetable. The Buddhist priests eat them thus in the Peking temples. The roots also furnish a drug which is said to be very useful in cases of dysentery, being a powerful astringent. The bark of Ailanthus excelsa is used in the same way in India. The ailanthus grows very swiftly, and is content with most sterile soil, and is used for feeding a variety of silkworm in Shantung.

A. Vilmoriniana is used for the latter purpose

[1] Taintor: *Notes and Queries*, vol. iii.

in Szechwan, where Wilson observed saplings so used. He also noticed a specimen of this tree 150 feet tall in Hupeh.

ALBIZZIA LEBBEK, Benth.
Chinese Name—Ye-ho shu.

Spread throughout tropical and sub-tropical Asia, this albizzia has hard wood with a handsome grain, rendering it suitable for fancy work. Hosie states that in Szechwan it is made into frames for mirrors and small toilet articles. It derives its Chinese name from the fact that its flowers close at night. The central doors in Confucian shrines are often made of it, and as the flowers of the tree close, so these doors are always closed, even to the Emperor himself, for the entrance to a Confucian shrine is gained by the two side doors only.

Albizzia Julibrissin Durazz. A small tree of wide distribution, provides wood for furniture.

ALDER

ALNUS CREMASTOGYNE, Burkill.
Chinese Name—Pa.

The alder does not appear to have a wide range in China, having been traced only in the

west of Hupeh and in parts of Szechwan. Hosie says it "grows in profusion on the banks of every rivulet and canal in the Chengtu plain, and, while mostly felled, owing to its quick growth, for firewood, it serves another useful purpose. Owing to its light weight, it is made into boxes for the carriage of treasure from one part of the province to another. It costs only 3 to 4 cash per catty." In the western highlands of Szechwan the trees grow abundantly and reach 100 feet in height, but the white alder (*Alnus incana*) is found only in Manchuria, far north, along the whole course of the Amur, and, indeed, as far as Sakhalin. Seebohm states that in Siberia this tree reaches a limit of 69½ deg. N. lat. It is not of large dimensions.

ASH.

FRAXINUS.

Chinese Name—Huai.

The ash attains its best development in Manchuria, where, on the middle Yalu, it grows to the height of 100 feet, with a diameter of over 6 feet. Here it prefers northern aspects in valleys and damp places. The wood is white

with a slight yellowish tint, and, although the grain is not close, the wood is hard and heavy. It endures strain very well and moisture, and is used in ship material, for tools, mirror-frames, gunstocks, carts, and clogs. Quantities are being used for sleepers on the Manchurian railways, with good results. It is sometimes mistaken for the valuable wood keyaki (*Zelkowa accuminata*). Ash is easy to cut and work, and bears transportation well, as it does not split readily. The price is Tls.3 to 5, but the output is limited. This species is F. Sieboldiana, Bl., Chinese Shui chü liu. It is also found on the Sungari, where, however, it grows only to 60 feet. This is also the height attained by F. Manchurica, Rupr., on the Amur and Ussuri.

The ash also grows well in Western China, but not north of the Han. In Kiating prefecture, Szechwan, the female wax insects (*Coccus pe-la*) are brought from their home in Ningyuan to feed on F. chinensis, Roxb., and deposit the secretions which, as white wax, are used for coating candles, glazing paper, etc.[1] The cantharides feeds only on the ash in China.

[1] For an account of this industry, see Hosie's lengthy report.

BANYAN.

FICUS RETUSA, L. Bentham, evergreen.
Chinese Name—Yang.

This magnificent evergreen shade tree is found only in the more southerly provinces, but extends as far as the Yangtze in Kiangsi, flourishing on the rivers south of the Poyang Lake; it is at its best in Fukien province, the capital of which is named the Banyan City. It does not, however, reach Hunan. Early travellers in South China notice the banyan with admiration, and Lord Macartney's embassy record one whose branches covered half an acre in extent. It is of little economic utility, not being used even for firewood, and in this aspect Wu Kuan, a writer of the Ming dynasty, has picturesquely likened it to a man of high worth and attainments, who declines to accept office, preferring in rustic retirement to shed all the genial influences of his talents and capacities over his fellow-villagers.[1] The down-hanging shoots or rootlets are sometimes used for matchlock fuses, and the wood occasionally for barrow-wheels, while in the

[1] *Notes and Queries*, vol. iii. 1878.

island of Hainan the gum is mixed with gambier to make it fast.

The bastard banyan, or huang kuo shu, is a feature of Kweichow, Szechwan, and N.E. Yunnan, in which last district it is one of the few surviving trees, scorning fertile soil and revelling in rocky ground. This tree also grows to huge dimensions (Parker recording one 12 feet in diameter), and is useful as a shade tree.

The banyan grows also in Formosa and Tonking, and appears to be identical with that of India, Ceylon, and Malaya.

BEECH.

It was stated by David that the beech was not found in the Chinese region, and others have repeated the statement. But two species of the tree have now been identified, though it is rare. Along the course of the Upper Min, in Szechwan, it has been observed in some quantities, and in the mountains of W. Hupeh, between 3,000 and 7,000 feet; but, as far as can be gathered, nowhere in the plains. North of Ichang Wilson found forests composed solely of beech—Fagus

sinensis, a tree 60 to 70 feet high, with many trunks, and another resembling the European beech, but smaller. Local name, Peh litzu.

BIRCH.

BETULA, sp.
Chinese Name—Hua, or Tan.

The birch can hardly be called a native of China proper, but flourishes in all the northern and western frontiers. It still, however, survives in the old hunting forest of the Emperors in N. Chihli, and the red-barked variety is one of the most numerous trees in the N. Tsingling Mountains, while the white-barked kind grows to the south. It begins in Manchuria in the central ridge of the Liaotung Peninsula, and is a feature of the great forests of Manchuria, extending thence along the whole course of the Amur, while great forests grow on the Siberian steppes, and the tree is found along the ranges north of Mongolia and Turkestan, in the Kuenlun, and in Tibetan Szechwan, and has ever been noticed in the Kakkyen region (by Anderson).

In the Amur region Ravenstein notices B. daurica, which has a darkish brown bark, useless

because it peels off in lamellae; B. alba on mountain slopes, with a trunk 2 to 3 feet thick; B. costata, from the Bureya to the Usuri; B. Erma and two stunted varieties on the lower Amur.

On the Yalu the species B. Bhojpattra, Wall, var. Typica, Rgl., grows 60 feet high, with a circumference of 5 feet. The wood, especially the heart wood, is very hard and close grain, so that it is called the axe-breaker. The old trees have very thick bark, and escape forest fires—the tree grows over burnt pines. The wood is used for making walking-sticks, trays, combs, bowls, and especially cart-axles. The yearly output is 600,000 cubic feet, half of which comes down the Yalu and half by road to Central Manchuria from the western side of the Yalu watershed. This variety has been erroneously described as the red elm (from its local native name). On the Amur the bark of B. alba is peeled off in strips, 2 to 4 yards long, softened by steam, sewn together, and used to make waterproof mats, canoes, pails, baskets, cups, etc.

In N.W. Szechwan (Mantzu land) great forests

of B. utilis, D. Don, cover a vast extent of territory. The yellow inner bark of this variety is brought to Chentu to make the inner lining-bands of the large summer straw hats (Hosie). B. luminifera, the black birch, is found on Mount Omei.

In the Kara-bura Mountains the tree reaches an altitude of 8,800 feet.

BOX.

BUXUS SEMPIRVIRENS, L.

Chinese Name—Huang yang (yellow poplar).

Unknown in N. China (David), box grows in Fukien, Chekiang, Kweichow, and in Szechwan, where two varieties are found. It is grown as an ornamental shrub throughout Szechwan, but exists as a timber-tree on the upper waters of the Ya, where it is specially cultivated for its wood, which is the source of all the combs made in the province. It is valued at Tl.04 per catty. In Fukien combs, seals, and printing-blocks are made of it, and for the last purpose it is very highly valued. The average diameter of the trees obtainable is only 4 inches.

CAMELLIA SASANQUA, Thunb.
Chinese Name—Cha shu.

"Tea-oil" is produced from this camellia, which is extensively cultivated in many parts of the Nanshan, and is wild in W. Hupeh and south-west of Chengtu, in Szechwan. The shrub grows about 10 feet high, and takes about eight years to produce flowers and seeds after being planted. The method of extracting the oil is as follows: The seeds are thrown into a circular stone basin, in which a stone roller rotates, motion being given by a cow. They are then passed through a sieve, subsequent to which they undergo a boiling operation and are then placed in troughs, over which heavy wooden rollers pass, when the oil falls into jars below. The yield is 50 per cent. Tea-oil is considered the best for dressing women's hair, and is also used as an illuminant, and to adulterate rape-seed oil. It is thin, slightly fragrant, and pale yellow. The refuse cake is a fertilizer, and is also useful for removing grease stains from clothes, and is said to destroy the insects which are noxious to rice-plants.

In S. Hunan the camellia grows well on the red-sandstone hills, and in Fukien on granite ; it is hardy and easy to cultivate, and the great world-demand for vegetable oils may bring it into prominence.

CAESALPINIA SAPPAN, L., which is found in the whole Indo-Malayan region, exists in China only in the island of Hainan, where, however, owing to its inaccessibility, it has not been exploited. It furnishes both valuable wood and dyes.

CAMPHOR.

CINNAMOMUM CAMPHORA, Fr. Nees and Eberm.
Chinese Name—Chang.

A native of Japan, Formosa, and China, this magnificent tree is venerated by the Chinese. Its habitat is the Nanshan range in its whole extent, and it reaches as far north as the right bank of the Yangtze in Kweichow and West Hupeh, and is found besides in Chengtu prefecture, and scattered throughout Szechwan to 3,500 feet.

The wood, which is rapid-growing, is easy to work, and much used, especially at Canton, in the manufacture of dressing-cases or to face

inferior woods in wardrobes, as the oil contained in it renders it distasteful to insects. Unfortunately, inferior woods are treated with the oil and made into imitation camphor-wood chests ; these, however, lose their protective power against insects as the oil evaporates. True camphor-wood is becoming scarce, especially in South China, where the trees have been mercilessly cut for the production of camphor. The British Consular Report for Foochow, 1906, is interesting reading in this connection. The Consul says : "The quantity exported has suddenly increased unprecedentedly (from 264 cwt. in 1902 to 13,535 cwt. in 1906) ; this is, however, but the expiring flicker. The camphor industry is handicapped by difficulties inherent in its methods of manufacture which are hard to remedy. The only way to extract it is by "destructive distillation"—i.e. the tree must be felled and its timber boiled. Unlike rubber, camphor will not flow when the tree is tapped, as it is present in the form of crystals. The Japanese have experimented to obtain it without destroying the tree. It was hoped at one time to get it from the twigs and leaves without

destroying the trunk, but without success, so that the only way to preserve the industry is by replanting. But it is a slow-growing tree [1] and not commercially productive until the age of forty, so quick returns are not to be expected. The Fukien authorities look to it as a productive source of revenue, and have tried to create a monopoly, but this has been resisted by the Powers. Now, the increasing exports show that the trees are being destroyed, and as their number here and in Chekiang is limited, extirpation is near. The Government requires five to be planted for each one cut, but many do not produce camphor. Systematic reafforestation is the only remedy. Reservations or nurseries, to be protected for fifty years, should be established at certain suitable points. It should also be ascertained whether certain camphor-trees produce camphor and others of an apparently kindred species do not, and why. At present this cannot be ocularly distinguished—only by experimentally boiling of chips can the difference be determined." There are many distilleries in

[1] This statement is at variance with that of Foxworthy in the paper on Indo-Malayan woods.

Foochow, but the industry is almost at an end. The Customs Report for 1910 contains the following pertinent suggestions: "To recover the ground that has been lost through the crass ignorance of the peasantry there are two courses open: (1) to obtain seeds from Formosa (where the industry flourishes under Government control) and commence Government nurseries; (2) from such to supply each family annually with a minimum of twenty young trees and compel the peasants to plant them. In fifty years, when they are at their best, Fukien would be practically reafforested. Moreover, when planted the trees will serve many useful purposes, in addition to their value as camphor. Those planted around the homestead will give a grateful shade in summer, besides affording protection against typhoons; those planted on the hillsides will attract rain-clouds, and thus increase a much-needed water supply, while those planted along rivers will serve to protect the banks against floods. At one time camphor-wood was extensively used for the keels of river junks and for the manufacture of coffins, but, owing to its present scarcity and consequent dear-

ness, it is now little used. Again, in the hot and humid climate of the south the average life of a railway-sleeper, even when creosoted, seldom exceeds three years, and should white ants appear (which they seldom fail to do), renewals of sleepers become necessarily frequent and expensive, whereas the camphor-wood sleeper is proof against the white ant pest and successfully resists the climate for from twenty to thirty years. The demand for sleepers alone would thus be very great. The planting of trees has now become essential for the future prosperity of the province. An experimental area should be retained, which should be added to every year." Indeed, it may be added that the cultivation of camphor should be one of the first measures to be taken up in any afforestation scheme in China. The world supply of camphor is now derived almost entirely from Formosa alone, and China is neglecting a source of considerable wealth. In South Hupeh, indeed, there is an increasing production of camphor, and, in the hands of a vigorous syndicate (which holds the monopoly), the industry may develop in this unexpected quarter.

Large quantities of camphor-wood are sent

from Kwangsi and Kweichow timber districts to Wuchow, "where the wood is so lightly valued on account of its abundance that it is sold as firewood at $6 per ton." [1] In S. Hunan planks 2 ft. 6 in. wide are easy to get, and trees over 20 feet in circumference are not uncommon; and in Kiangsi, too, trees of vast size are to be found. Should the camphor industry spread to these provinces, where it has not yet taken root, it may indeed develop beyond all expectations.

The wood furnished by the thick main roots is known as "Ying mu," and is valued for cabinet-work in W. China (Wilson).

Cassia, or Cinnamomum Cassia, Bl.

An account of this tree appeared in vol. ix. of the *China Review*. Cassia is cultivated largely in the Sunchow prefecture of Kwangsi province. There are three varieties of the tree—one with a leaf resembling that of the tallow-tree, and the others similar to the persimmon and loquat respectively. Cassia lignea or bark, twigs, and buds or seeds (which last resemble small acorns) are all made use of in various ways for their

[1] Extract from a report in 1900.

tonic qualities. The buds constitute a spice for confectionery, the twigs a febrifuge; the seeds are taken steeped in wine or eaten with betel-nut, and the flowers are used dried. Cassia tissue consists of the inner lining of the thick bark taken from just above the root of the tree, where the greatest quantity of sap has accumulated. The oil distilled from cassia is also of good quality. A plantation may be barked after it has attained a growth of five years, and the most suitable time for barking is in spring or autumn, when there is a strong flow of sap.

Cassia has sometimes been confused with Olea fragrans (Chinese, *mu si*), which has a larger leaf. This olea provides the famous "kuei hua" flower, a favourite in Chinese gardens.

CATALPA BUNGEI, and C. DUCLOUXII in the West.
Chinese Name—Chiu-Tzu Shu.

This shade tree, which is of very rapid growth, is a native of the Yellow River basin, and extends into Shensi and W. Hupeh. Near Ichang it is used in boat-building, but in Shantung only for making musical instruments, chessmen and tables, and weighing rods. The tree

is especially useful for ornament and as a shade tree. In the United States C. speciosa has been introduced in the dry regions of Kansas, Nebraska, etc., as a commercial speculation. It is very hardy and singularly free from destructive diseases, both when living or as timber,[1] so that its congener might with advantage be cultivated in China for sleepers, telegraph poles, etc. The Chinese make a lotion for wounds from the leaves.

CEDRELA ODORATA, or CHINENSIS, A. Jussieu.
Chinese Name—Hsiang Chun.

The cedrela belongs to the order Meliaceae, and has been named Chinese mahogany. The wood, described by Hosie as beautifully marked with red bands on a yellowish-brown ground, is largely used where available for furniture, and would be suitable for cigar-boxes. It was described by Grosier as the frêne odorant, and closely resembles the ailanthus, but is without its bug-like smell, having, on the contrary, a pleasant lemon smell, from which it derives its name of the fragrant chun, in contradistinction

[1] J. R. Baterden, *Timber*, p. 117.

to the ailanthus, or malodorous chun. The young shoots are boiled and eaten by the Chinese, who enjoy their slightly oniony taste. The fruit is an astringent which is used in eye diseases. The tree is domesticated in Peking, but is found wild farther west, and being very good and strong, is employed near Ichang to make the sides of canoes and for ship-building in Hunan, though now too valuable and heavy for house-building.

The habitat of the cedrela appears to be the belt between the 31st and 38th deg. of north latitude, but it is also found as far south as 29 deg. in N.W. Hunan.

It is interesting to note that Cedrela (or Toona) serrata of India is named "Indian mahogany," and is a very valuable wood in the tropics, being termite-proof, as, indeed, are other toona of India, Malaya, and the Philippines.

The cedrela of W. China is described by Wilson [1] as follows: "It furnishes valuable timber, beautifully marked with rich red bands on a yellowish-brown ground. It is easily worked, does not warp nor crack, and

[1] *A Naturalist in West China*, vol. ii. p. 22.

CELTIS SINENSIS.

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is esteemed for making window-sashes, door-joists, and furniture. The tree grows 80 feet tall, the trunk is very straight, and but little branched. It is quite common in western Hupeh up to 4,500 feet.

CELTIS SINENSIS, belonging to Ulmaceae, is, according to David, found all over China, but has received scant notice. The tree ranges over Southern Europe, tropical and temperate Asia, and is rather local in hilly country. David particularly notices it in the Tsingling Mountains and in S. Kiangsi, and Wilson found it scattered in W. Hupeh.

CHERRY.

The wild cherry grows in the Tsingling, where its wood is valued in the furniture trade, and in the Tibetan borderland as high as 12,000 feet, as well as in the upper forests of W. Yunnan. On the plateau of this province—an orchard district of great promise—the cherry is one of the fruits cultivated. Prunus serrata was found by Wilson.

CHESTNUT.

CASTANEA.

Chinese Name—Li.

The chestnut appears to grow "a little everywhere," as David says; at least, in the Yangtze basin and on the north slope of the Tsingling, but not in the far north (C. mollissima is found in Chihli) or the western highlands. In W. Yunnan it is abundant, and in S. China it seems to be replaced by the castanopsis, a congener of the "Indian chestnut" of the Eastern Himalayas. Castanea sativa, Mill., is a common tree in Szechwan (Hosie), where the wood is used to make furniture at 16 cash per catty. In W. Hupeh cart-beams and knees of boats are made of it. Two kinds are enumerated by both Gardner (Ichang) and Fortune (Chekiang): (1) like the Spanish chestnut, with large fruit; (2) having a delicious small fruit, resembling the hazel-nut in size and shape. It is the wood of the latter kind which is of value, but for charcoal both trees are good.

CUDRANIA TRILOBA, Hance.

Chinese Name—Cha.

A thorny tree, which is used in the feeding of

silkworms in Kiating (Szechwan) and Shantung. The leaves are cut fine and given to the worms as soon as they emerge from their eggs, and before mulberry-leaves are given them. The timber is used to make the smaller articles of furniture. The tree grows to 4,500 feet altitude.

DALBERGIA.

Chinese Name—T'an.

The question of the identity of "rosewood" has not yet been investigated in China. Indeed, "rosewood" is a term as generally applied as "ironwood," and to almost as great a variety of plants in different parts of the world. Most of the rosewoods (of which there are more than thirty kinds) have heavy, dark-coloured woods, and many belong to the Leguminosae, in such genera as Dalbergia and Pterocarpus.[1] The t'an mu is described by Duhalde, and appears now to be identified as a Dalbergia. Duhalde says: "No kind of wood, for beauty, can equal the Tse-tam; it is of a reddish-black, and full of fine veins, which seem painted. It is very proper for cabinets and the very finest sort of joiners' work, and whatever is made of it is in great

[1] *Philippine Journal of Science*, vol. iv. No. 4.

esteem." The rosewood-tree was found in W. Szechwan by Abbé David, who states erroneously that it is of the same genus as Laurus camphora. At that time (1872) it had already become very rare. The t'an is found in the mountains near Hsingan, in S. Shensi, where a missionary has described it as "like rosewood, very hard and durable." Professor Baillie states that it is the toughest of all the woods in use at Nanking, where it is used for wheels and shafts—when it can be had.

Dalbergia hupeana, Hance, is described by Hosie as having "wood white and exceedingly heavy, worth 15 to 16 cash per catty. Almost exclusively used in building wheelbarrows, which are so much used in the Chengtu plain, and in making the handles of carpenters' tools, blocks and pulleys for native craft, and the rammers for oil-presses." The tree grows 80 feet high, but is never of any great thickness; it is widely spread in the west up to 3,000 feet altitude.

The blackwood, from which the famous furniture of Canton is made, is not of native origin, but seems to be the wood of Dalbergia latifolia, Roxb., native of India, the Andamans, and Java.

EHRETIA OVALIFOLIA, a small tree in W. Hupeh, has strong, light wood, used for making carrying-poles, etc.

ELM.

ULMUS, sp.
Chinese Name—Yü.

The elm occurs throughout China except in the south. It tends to become dwarfed south of the Yangtze, but in Manchuria is a fine tree, reaching 80 feet in height and 4 feet thick. Here it is the Ulmus campestris, var. vulgaris, Planch., and var. laevis, Planch., with dark grey bark, which scales off. It is the chief tree in the Yalu deciduous forests. Here it grows in the valley bottoms, but this wood is apt to be frozen and to split when worked. Those which grow on the hillsides are of better quality, but the wood is seldom cut into boards because of its tendency to split, as it expands and contracts with weather changes. The wood is dark, hard, and close-grained. Specific gravity unseasoned, 0·90; dried, 0·70; similar to the tso or oak. U. campestris grows nearly to the mouth of the Amur to a height of 50 feet. Uses: for small

tables, bowls, tops, trays, turnery, axe-handles, axles, furniture, pulleys, cart-bodies. It can be steamed and made into provision-boxes. The amount brought down yearly from the Yalu is 70,000 to 100,000 cubic feet, and the price is Tls.2 to 2.50 per 10 cubic feet.

The wych elm (*U. montana*) grows in the north, abounding from the Bureya Mountains to Mariinsk on the Amur, and on the coast south of Port Imperial. This also is a large tree, 40 feet high, with a thick and far-spreading top.

In Chihli province U. pumila, Pall., and U. parvifolia, Jacq., are common in the plain, but chiefly as bushes and in hedges. They can stand the sea-air well, as they grow near the sea. Elm-wood is employed in the Kaiping mines. In Shensi the elm grows only to 30 feet by 2 feet, and a tree can be purchased for 4,000 cash.

In South Anhui joss-stick powder is made from the bark of a species of elm, being the best powder made. Inferior powder is made from twigs and refuse of all kinds. The trade was formerly very large, 30,000 tons being the annual output.

GINGKO, OR MAIDENHAIR TREE.

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Mrs. Pruen notes [1] (in Szechwan) that "the two halves of the elm leaf in China always spring from the midrib uniformly, whereas in Europe the leaves (whether oval or angular) are distinct from those of other trees by the two halves being unequal at their base." Other Chinese Ulmaceae are the Celtis, Pteroceltis, Trema, and Zelkowa.

EUONYMUS EUROPAEUS, L., var. HAMILTONIANUS.
Chinese Name—Pai ch'a.

The wood is used in Chekiang for carving and engraving blocks, as a substitute for boxwood, but has been found indifferent for this purpose.

GINGKO BILOBA, L.
Chinese Name—Paikuo shu.

Named Salisburia adiantifolia by Fortune, this is the "maidenhair"-tree, from its leaf; it is found stretching across Central China from Kiangsu to W. Szechwan, but is said to be grown only in temples and other gardens. This remarkable tree is the most interesting in China, if not, indeed, in the whole world, for it represents the sole link between trees and ferns now surviving. In remote geological times the gingko was widespread, as attested by its fossil leaves, found in

[1] In her book *Western China.*

several countries in the Lower Eocene formations—e.g. in Mull. It now exists only in China, and the mode of its survival there is a puzzle; but the tree is well adapted for acclimatization in temperate regions, where it has been successfully grown. Though the gingko attains a considerable size, its wood does not appear to be much used. But its fruit, which is not unlike an apricot, is extensively used as a peptic, the kernel furnishing the "sal-nuts" of commerce, also as an article of diet in soups.

GLEDITSCHIA SINENSIS, Lamb.
Chinese Name—Tsao-k'o shu.

Common north of the Yangtze, this fine tree, which grows to a height of 60 to 100 feet and up to 3,500 feet altitude, is famed for its long black pods, which contain a yellowish, tough, spongy pulp, the tallow in which, when broken up and rubbed in water, forms a lather much used as soap. The ashes are used to restore animation in partially drowned persons.

C. officinalis, Hemsl., has small black pods, used medicinally. Skins are washed in water mixed with the pulp preparatory to curing.

G. horrida is found near Peking.

GLEDITSCHIA SINENSIS.

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GYMNOCLADUS CHINENSIS, Baill.; the Asiatic representative of the Kentucky coffee-tree (Wilson).

Chinese Name—Yu-tsao-chio.

The pods of this tree contain a thick layer of brown tallow from which, when mixed with water and steeped for two days, a soap is obtained. Grows to 60 feet.

HORNBEAM.

Common in W. Hupeh, in the mountains, and in Szechwan. On the lower Yangtze its wood is used for making agricultural implements.

JUJUBE.

ZIZYPHUS JUJUBA, Lamb.

Belonging to the Buckthorn order (*Rhamnaceae*), is widely spread through North China, where the fruit, the well-known "Chinese date," is a delicacy preserved in syrup or dried. Found also in Shensi, where it grows well even in the dry regions of the Yellow River, in Szechwan, and in Fukien, where the wood of the tree is valued for making combs. From other species of Rhamnus, as R. dahurica, Pall., a fine green dye is extracted.

KATSURA (*Cercidophyllum japonicum*, var.

sinense) has been identified in Anhui, and in N.W. Szechwan, where " it attains to greater size than any other tree from the temperate zone of East Asia, being only approached by its close ally the Tetracentron (Wilson).

PRIVET

LIGUSTRUM LUCIDUM, Ait.

This tree is best known as the one on which the wax insects live, and are cultivated for their wav. In S.W. Szechwan (Ningyuan) they are removed to Kiating, to deposit their secretions on the ash-trees which abound there; but elsewhere, as in Shantung, the wax is produced on ligustrum itself.

The wax produced in other parts of China is considered inferior to the Szechwan wax, but a certain quantity is still produced in Shantung and elsewhere. The wood of ligustrum is very tough, and used for a variety of articles. The tree is bent when young so that it assumes any shape desired, and thus excellent hay forks, all of one piece, frames for the backs of mules, on which packs are bound, handles of large baskets, walking-sticks, etc., are made with it.

LIME.

TILIA.

Chinese Name—Tuan.

The lime is known in parts of central China, and in S. Kansu, but is of most importance in Manchuria, where Tilia cordata, Miq., grows in all three provinces. In the north it does not exceed 40 feet in height (by 2 in diameter), but on the middle Amur, where it grows with maple and oak, it reaches 60 feet by $3\frac{1}{2}$ diameter, and on the Yalu it is as high as 80 feet. The fibre from the bast is made into ropes by the Goldi tribes, and into ropes, sandals, and cloth by the Chinese. This cloth is the same as the atsushi of the Ainus of Japan (cf. also "Russia matting").

The wood is white and soft, handsome, and easily worked. Uses: pencils, furniture, tools, and lately paper, matches. Value at Antung: Tls. 2 per 10 cubic feet.[1] Output: 50,000 cubic feet on the Yalu. In the cultivated plains and valleys of S. Manchuria, where trees are comparatively scarce, the lime is used in building and for other important purposes.

T. Manchurica of N. Manchuria is a small

[1] Japanese.

tree. Tilia Henryana grows to an immense size in W. Hupeh.

LIQUIDAMBAR FORMOSANA, Hance.
Chinese Name—Fêng.

This interesting tree, whose congeners are found only in Anatolia and the eastern coast of N. America, is often referred to in ancient Chinese records. Its wide extent indicates that it once formed a considerable proportion of the ancient forest of China, and it exists also in Formosa and Hainan. It is a fine shade tree, but the wood offers little resistance to damp and termites, so that, as Havret says, this king of trees is sold in vulgar planks to make tea-chests—it has no other use.

Its gum, named *chu ling*, is used as a specific against fevers, and in Hupeh to fix gold leaf. The Hakkas in the south employ the leaves as a remedy for cutaneous diseases. The liquid storax largely imported into China is the product of the liquidambar of Asia Minor.

A kind of wild silkworm feeds on the tree in Kwangtung and Hainan, and very strong fishing-lines are made from its silk, which is exported to Japan.

FÊNGYANG TREE.

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The tree is found all over W. China to an altitude of 3,500 feet.

Litchi.

The fruit of the Nephelium Litchi, Camb., an evergreen found in Fukien and Kwangtung principally, is one of the most popular among the Chinese. The litchi-tree furnishes a hard wood used, in shipbuilding, for the knees and similar parts of junks constructed in the south.

MAPLE.

Acer.

Chinese Name—Sê.

A. tataricum, L., var. Ginnara, Max., does not exceed 20 feet in height in N. Manchuria, but is more than double this height in S. Manchuria, where it grows in all the forests except the larch region on the Yalu. The wood is white and close-grained, and valued for good furniture. Some specialists state that it lacks durability, and in any case the amount cut is small. Three other maples occur in the Amur region. In Western China maples occur in Hupeh (*A. griseum*), the Tsingling, S. Kansu, W. Szechwan (*A. Davidii*), and N. Turkestan.

Of the Meliaceae the Aglaia furnishes a good wood for cabinet-work, and besides the Amoora, Turraea, and Cedrela (q.v.), the best-known representative is

MELIA AZEDARACH, L., or PRIDE OF INDIA,

found in Central China and Szechwan. The wood is little used; the fruit is a disinfectant and febrifuge.

MULBERRY.

MORUS ALBA, L.

Chinese Name—Sang.

Throughout South and Central China, and found on the upper course of the Yellow River, and even in Turkestan, on irrigated land. Cultivated in the silk industry, it is at its best in the silk districts of Chekiang, Kwangtung, Szechwan, etc., in alluvial soil. Grows wild in hilly districts, as in Hunan and W. Yunnan, where the aborigines make cross-bows of the wood, which is very tough and flexible. The wood is used for furniture and agricultural implements.

Broussonetia papyrifera, Vent. Chinese Kou shu, the paper mulberry, is widely distributed,

but paper is made (from the white inner bark), especially in Kweichow, Kwangsi, and on the Burmese frontier in Yunnan. It grows up to 4,000 feet, and is about 40 feet high.

PERSEA NAN-MU, Oliv.
Chinese Name—Nan.

This famous tree is first mentioned in the pages of the Jesuit writer Duhalde,[1] who says: "They esteem most Nan-mu (they have most kinds of wood to be found in Europe); the ancient palaces of the Emperors have the windows, gates, beams, and pillars of this wood. They imagine it will never decay, and consequently that what is formed with it will last for ever. Some have supposed it to be a kind of cedar, but the leaves are not at all like it. It is a very tall tree, and the body is very straight." A later account of the nan-mu is given by Consul Davenport, in his report of the Yunnan Mission in 1877, which seems worth reproducing. It is as follows: "The north-east of Yunnan produces the famous nan-mu, so highly esteemed by the Court for building purposes and by the wealthy for coffins, on account of its durability.

[1] *Hist. of China* (Eng. trans.), vol. i. p. 12.

It is to be seen in perfect condition after three centuries in the shape of enormous pillars in the Ming Tombs. The tree is tall, thin, straight-growing, having no boughs or twigs on the stem, but suddenly shooting out branches at the top Its bark is of a peculiar ashy grey colour. During the Ming dynasty the wood had already become scarce (having probably everywhere been cut down and not replanted), and was brought chiefly from almost inaccessible valleys, situated in the mountains inhabited by wild tribes. The Imperial Palaces at Peking were built almost entirely of this timber, Kia Tsing in 1558 making use of 15,712 logs or trunks and Wanli of 5,600 in 1597. The regulation block or log measured 82 feet in length and 13½ in circumference. As the wood had to be dragged over several mountain passes till streams were reached affording easy communication with the Yangtze, a large staff of men was attached to each of the depots established in this region by the Central Government—men specially hired from Chenchowfu, in the timber district of Hunan—100 woodcutters, 20 engineers, 20 stonemasons, 20 blacksmiths, 50 ropemakers, and corvée men. By 1668 the

wood had become so scarce that in the Taihotien deal was used as a substitute. The best-known localities in Yunnan for the production of this wood are Wulukou and Yuchiaop'ing, in the Tungshan district of Chaotung.[1] At present this wood is imported to Shanghai in planks, measuring 8 feet by 14 inches in diameter, for which the highest price is $200 per plank. Whole coffins range from $100 to $800, while small pieces are sold at 10 to 50 cents per catty. The quality is judged chiefly by the pungency of the scent."

Nan-mu was long mistaken for teak, but it is, as David points out, a member of the Lauraceae. Some of the medang-wood, well known in the Philippines, is Machilus, but this wood has not the value of its extra-tropical congener. It has been difficult to ascertain its range in China, but it appears to be confined to the following areas: the whole of the Chengtu plain in Szechwan and the adjacent hills, parts of the province near Shuting, to the north-east, but especially regions in the west, on the River Min at Kuanhsien, and the great forests of the sacred mountain Omei-

[1] Not long after these words were written the production seems to have ceased altogether.

shan. The chief producing districts at present are in the vicinity of Jenhuai, on the Kweichow border, and the tree extends along the whole border between the two provinces, and into the north-west corner of Hunan. (Shênchow is said to be the only place in Hunan where the wood can be bought.) The tree also grows in the wild region east and south-east of Ichang. In N.E. Yunnan but few specimens survive of the forests which once supplied the Imperial palaces. The districts mentioned lie between the 103rd to 109th parallels of longitude and the 28th to 32nd parallels of N. latitude. But nan-mu is said also to occur in N.W. Fukien; if this be the fact, its survival in a region so isolated from the habitat of the rest of the genus must be due to the inaccessibility of the hills of N.W. Fukien, for the tree must have been extirpated wherever accessible. It is said to have existed formerly at Talifu, in W. Yunnan, and Davenport saw a tree resembling it very closely on the Burmese frontier.

There are several varieties of Machilus, but the M. nan-mu seems to be the most common. It is highly esteemed for ornamental furniture,

costing Tl. 1 per Chinese cubic foot at Chengtu. The wood is of fine grain, and compares favourably in appearance with walnut when polished, but is much softer; the stocks of rifles made at the Szechwan arsenal were at first made of this wood, but it was abandoned on account of its lightness in favour of walnut. Large specimens can still be obtained in the hill country of W. Szechwan, Andersson having noticed specimens 150 feet high in the Omei region. In the Chengtu plain the tree flourishes in alluvial soil, resting on a pebbly bed. Here and near the Yangtze the trees are cultivated, and used largely in shipbuilding for making pegs and stanchions, and the boatmen usually affix one strong beam of this wood to the water-line of their large cargo-junks to resist bumps. As this is one of the most valuable woods in China, every effort should be made to encourage its cultivation and replantation in the districts where it formerly flourished.

Wilson says [1] that nan-mu includes a number of species of Machilus and Lindera, all being evergreen and singularly handsome trees, with

[1] *A Naturalist in Western China*, vol. ii. p. 21.

close-grained, fragrant timber, which is greenish and brown in colour, easily worked, and very durable.

OAK.

QUERCUS.

Chinese Name—Hsiang, Chê, Tso, etc.

The oak grows in every province of China, though in the sub-tropical area only in hill country. Though inferior to the European oak, it is of considerable importance as a hardwood tree. Sixty species are said to exist.

In N. Manchuria Q. mongolica is met with first at Albazin, on the Amur, as a shrub; below the Komar it occurs as a stunted tree; and it is not until the Bureya Mountains that it assumes larger proportions, and on the middle Amur it is one of the most frequent forest trees, growing together with the bird cherry and ash on level tracks and with other deciduous trees on mountain-tops. Here it is 40 feet high by 5 feet thick, but, unfortunately, generally rotten to the core. Only in the Bureyas have good sound oaks been found. On the Lower Amur it is again of dwarfish growth, but near Vladivostok it is a fine tree, and the staple of the seaboard.

In the Sungari forests the same oak grows to the same proportions as in the Bureyas; it is used to make sleighs, cart-shafts, and for fuel, and, with better means of transport, will be used for building purposes. On the Yalu Q. Crispula, Bl., and Q. dentata, Thun., reach 70 to 80 feet in height, and are found everywhere. These trees are highly valued for their wood, which is hard and resists decay. Owing to its tendency to warp and split, it was not until lately much appreciated in Japan, but now it is steam-dried and used in machinery and for shipbuilding, and, as it resembles American oak, for beer and wine casks. It is also used for axles, sleepers, oars, and for fuel, providing the best charcoal in the market. In the wild-silk industry, both in Manchuria and Shantung, these oaks are used for feeding the larvae, together with Q. aliena and Q. serrata. This last has leaves resembling those of the chestnut, and is preferred for the silkworms in their younger stage; this is the ch'ing kang, while Q. dentata and Q. aliena are named the hu po lo or tso, with very large and medium leaves respectively.

The ch'ing kang flourishes also in W. Honan,

N. Kweichow, and Szechwan, where it is used to feed the wild silkworms of these provinces. This species flourishes on sunny slopes and in warm valleys, in conditions which are favourable for the worms. To secure the largest possible leaf the hu po lo is cut every few years, and one tree at its best is capable of feeding fifty worms.

These trees are, when exhausted, largely used for fuel, the thicker stems being laid out in great heaps to dry, and sent to the towns, and the smaller branches and leaves providing fuel locally, while twigs and leaves are sometimes mixed with loam for manure. A great deal is used in the form of charcoal.

PEZIZA AURICULATA.
Chinese Name—Mu Erh.

Another use to which oak-trees are put is for the production of "fungus." This lichen is an export of Manchuria, but more especially of the southern slope of the Tsingling Mountains, in Shensi, where in some localities the oak is the basis of the woods. For the raising of fungus three conditions are essential: (1) the presence

of oaks; (2) granite hills; (3) a humid atmosphere with sufficient heat in summer. The Chinese cut a large number of small oaks and remove the branches, leaving, however, the bark intact. These are then leaned against a long trunk, placed horizontally at a height of 6 feet, and in the following summer the brown fungus appears on the dead trunks, to be collected as it grows. A long period of rain is favourable to the development of the fungus, which when not cultivated grows naturally on decaying stumps. It is an indispensable delicacy at all Chinese feasts. Large quantities are shipped to Hankow for distribution, and fungus is also produced in Kwangsi.

Other uses made of the oak are the production of dye from the fruit and bark, while the bark also provides a gum.[1]

In South China oak is not valued for its wood, partly because with the primitive native tools it can only be sawn and shaped with great labour, and partly because the termites specially affect it. But in the hills of W. Hupeh it makes strong

[1] The Chinkiang British Consular Report for 1906 states that a gum industry was started near that port.

bottom boards for canoes, and, as trees of good size can be obtained, the industry may become profitable. For agricultural implements and tools the tough wood is well suited, and in Szechwan it is in great demand for carrying-poles, which cost as much as Tls. 15 a pair. The Lolos make spears of oak.

In Szechwan there are twelve varieties of oak, and on the Tibetan borderland the holly-like oak is an interesting feature. Q. ilex and Q. obovata are well known, but no complete classification of Chinese oaks has yet been made.

The thrifty Chinese use the large leaves to line tea-crates, or as a substitute for trays in cooking and steaming bread; and in years of scarcity acorns are ground into flour, made into a substance resembling bean-curd, and eaten by the poorer classes. These are probably the fruit of Q. cornea, Lour.

ORANGE.

Several species of orange are native to China, where this fruit is perhaps the most largely grown of all. It is one of the chief products of S. Fukien along the coast, and another noted orange

district is the Yangtze valley above Chungking. The wood is hard and valued in Szechwan, etc., for making the handles of tools.

ORMOSIA HOSIEI.
Chinese name—Hung Tou (Red Bean Tree).

This tree, which, as its name implies, belongs to the Leguminosae, is allied to the Sophora. It is the most valued of all woods in Szechwan, on account of the weight and beautiful markings of the grain, which is of a rich red colour, while the wood is heavier than water. It is used for high-grade cabinet-work and expensive furniture. It was formerly fairly common and cheap, says Wilson, but the tree has been ruthlessly felled. In the Chengtu plain it is now only to be found in temple gardens, but in north-central Szechwan it still exists in some quantities, and in the high mountains near Hsingan, in Shensi, it grows to a large size, and is not much used.

Hosie, from whom the tree has been named, states that the wood costs Tls.2.40 per picul at Chengtu, and that a pair of poles of this wood are valued sometimes at the fancy price of Tls.100.

PERSIMMON.

Diospyros Kaki, Linn. f.

Common both in the south and as far north as Chihli, while it is largely cultivated in Shensi and Szechwan also. Persimmon belongs to the ebony order, and the wood is dense and hard, and in some parts perfectly black. D. Lotus is found in W. Szechwan up to 4,000 feet; it is the Kou-shih-tzu.

Diospyros kaki: its wild form is the Yu-shih-tzu, or oil persimmon. This latter grows in Central and Western China in the hills up to 4,000 feet, and attains a height of 60 feet.

Phellodendron amurense, Rupr.
Chinese Name—Huang pi lo.

The cork-tree of Manchuria. Distributed along the middle Amur, and goes to 50° 10′ N. From 50 to 70 feet high, it has a straight trunk and a fine, dense top. The wood is light yellow, hard, and strong. On the Yalu, where there is a fair quantity, the wood is valued for furniture and tools, and may be available for sleepers. Value: Tls.2 to 3 per 10 cubic feet.

The bark of the tree consists of two distinct

layers, the outer of which is ½ inch thick and of the usual cork colour; the inner ¼ inch thick or more and lemon-coloured (Ravenstein). But pieces have been seen 3 inches thick, and there are prospects of this bark being extensively used in the cork industry. The natives use it to float their nets. The inner bark is used as a drug and dyeing material in Japan, Korea, and China.

PEAR, WILD.

The Service-tree (*Pyrus* or *Sorbus aucuparia*) grows on the whole course of the Amur.

PEAR.

PYRUS SINENSIS, Lindl.

Found in all parts of the country. Its wood is universally used for book-blocks, wood-engravings, seals, visiting-cards, etc. Also used for making combs, which are dyed yellow with the fruit of Gardenia florida (Hosie), so as to resemble yellow boxwood. In Fukien two varieties—white and red—are used. The fruit is very largely eaten, but needs improvement. The Shantung and Shansi pears are reputed the best.

PISTACIA CHINENSIS, Bunge.

Central China. One of the few trees on the arid slopes of W. Shensi. Its young spring fronds are highly appreciated as vegetables in Szechwan. Its dark-coloured wood is hard and tough, and highly valued on the middle Yangtze for rudder-posts. The "huang-lien" grows to 5,000 feet altitude.

POPLAR.

POPULUS, sp.

Chinese Name—Yang.

The poplar, of which there are many varieties in the confines of China, does not appear to grow south of the Yangtze basin. David enumerates four poplars north of the great river, viz. P. acuta (white-barked), P. coriacea, P. ta-yang, and P. venusta (apparently the aspen). In Shantung P. alba and P. nigra form a pleasing feature of the landscape, and, in a province where there is little variety of timber, are of great importance to the people, as both furnish a light and good timber for carving and junk-building. P. alba, L., and P. balsamifera, var. suaveolens, Loudon (called by the Chinese the green *yang*), flourish

also in Chihli in the plains; they are very large and hardy, and useful as wind-breaks in the storms of winter.

In North Manchuria P. suaveolens grows along the whole course of the Amur, and attains a height of 40 feet, but in the Yalu and Sungari regions it reaches sometimes 100 feet; it is the largest of the broad-leaved trees in Manchuria. With the white and yellow poplars, it possesses soft, white, and easily worked wood which is not liable to split. These trees are used for building, for furniture, and, the smaller ones, to make fences and fuel; but lately the large boards have been employed by the S. Manchurian Railway Company to construct coaches, and the value of the wood has become enhanced. The white poplar, which averages only six inches in diameter, has recently been used in the match-making industry, and as the supply of match-making material is becoming scarce in Japan, fresh supplies will be sought in these regions, where the poplar, though scattered, can be found in abundance. The trees, growing in mixed forests, have till now been largely spared, as the wood is inferior to other local woods. The

pulp industry would also seem to have hopeful prospects here.

The aspen (*P. tremuloides*) also flourishes in Manchuria, especially on the Ussuri, where it is 50 feet high by 4 feet in diameter. It is found, too, in the mountains north of Turkestan, and in the Altai is gradually spreading more than birch, as it grows better on cleared land. With good soil and climatic conditions it attains in sixty years to 90 feet, and has a clean and healthy fibre (S. Turner, *Siberia*).

In the wild regions on the Tibetan frontier, and in the milder parts of Tibet itself, the poplar is the chief tree planted wherever there is cultivation in the valleys. This is P. euphratica,[1] which also appears in Turkestan, where, with P. balsamifera and P. diversifolia, it is the principal, or in parts the only, tree. In the irrigated areas it is of the utmost importance to the inhabitants, providing fuel, shade, etc. The toograk (*P. diversifolia*) forests are a feature of the Kashgar, Yarkand, and other rivers, protecting them from the encroachments of the sands.

[1] P. euphratica is the only poplar found in India, in Sind, the Punjab, and Kashmir.

P. Villosa is a common tree in W. Hupeh, from 1,500 feet to 3,000 feet, and yields a wood valued for building purposes, furniture, and carving. In the same region P. lasciocarpa branches are driven into the ground to make fences; these branches take root and form groves (Wilson).

PTEROCARYA STENOPTERA, C.D.C. and P. HUPEHANA.
Chinese Name—Ma liu.

A useful shade tree in Central China from Kiangsu to Szechuan, growing in damp situations. Wood used for furniture. Platycarya is a relative, belonging also to Juglandaceae.

PUMELO.

Chiefly in the South Coast provinces, but also in Szechwan, where the wood is valued for agricultural implements.

RHODODENDRON.

Found in the Nanshan, but chiefly in the lofty ranges in the Tibetan region, where some kinds are 2 feet in diameter. Is in its native habitat here, and provides 130 species. The last tree

to die out on the mountains. Does not exist at all in the Tienshan or Alatau (Severtsof).

SAPINDUS MUKOROSSI, Gaertn.
Chinese Name—Hou-erh-tsao.

In Central China, to 3,000 feet. It grows to a height of 70 feet. Fruit furnishes soap of better quality than that of other soap-trees used for washing white clothes. Seed used for rosaries, and wood to make combs. The same tree also gives soap in India.

SAXAUL.

HOLOXYLON AMNODENDRON.

The saxaul grows to the height of 14 feet, and is $\frac{3}{4}$ inch thick at the root. Its chief habitat is the Gobi and the N. Alashan, Dzungaria and Russian Turkestan, though it is met with from the Caspian to the limits of China proper, and through nearly 12 deg. from the parallel of Lake Uliunghur on the north to the Tsaidam on the south, where it grows at an altitude of 10,000 feet. It is thus characteristic of all the Central Asian plains and deserts, and is of great use to the natives, for although it gives no shade, it

supplies them with fuel and their camels with food. Its wood, though hard and heavy, is exceedingly brittle, so it is of no use for building; but it burns splendidly, almost like coal, and retains its heat for long. Unfortunately, the saxaul has been exterminated in some parts round the centres of population.

Sophora japonica, L.

Chinese Name—Huai.

This ornamental tree is, according to Bretschneider, found all over China. It often attains a great age, and takes the fantastic shapes so dear to the Chinese taste. It is venerated and preserved, the branches being supported by posts, and shrines placed near the trees.

The sophora, which resembles the ash, blossoms in autumn. Its wood is used for furniture in Szechwan, where it costs Tl.o.o.1 per catty, and for agricultural implements in the Great Plain. But the tree is best known for the dye extracted from its buds and bark. This dye, which is yellow, is used for white silk and cotton, or for rendering blue stuffs green. A decoction is also made from the buds for the

treatment of sores. The seeds are used for dyeing neutral tints.

Another tree named "huai," and whose flowers also yield a dye, is the Koelreuteria apiculata.

Sterculia platanifolia, L. f.

Chinese Name—Wu tung.

This is the phoenix tree, famous in legendary lore as the only tree on which the phoenix would alight. It is indeed a most ornamental tree, affording a grateful shade with its massive leaves. The sterculiaceae, which resemble very closely the mallow tribe, have wood usually soft and light, and not durable; but the *wu tung* is valued for making furniture in Szechuan, where the wood is comparatively expensive, costing Tl. 1 per Chinese cubic foot. Hosie says that in winter the tree is reduced to a mere stump, as the branches are chopped off to yield their fibres, which are extracted by retting, and used for making matches, for matchlock twine, and sometimes for sandals. *Wu tung* is a feature of the Great Plain, where its wood is used for musical instruments. In tropical countries ropes are made from the fibrous bark.

THE PHOENIX TREE, OR WU-TUNG.

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TALLOW TREE.

STILLINGIA SEBIFERA, MICH., or SAPIUM SEBIFERUM, Roxb.
Chinese Name—Chiu.

This tree, which varies in growth from a small shrub to a stately tree, resembles the apple in form and the aspen in foliage. It grows, either wild or cultivated, through the Central and Eastern provinces, to the south of the Great Plain, but not near the coast except in Chekiang, though it is found in Chusan and Formosa. It is also common throughout Szechwan. In Central China it yields both tallow and oil, but only the former in the South. The tree was introduced to India over half a century ago, and grows well in the Punjab and other parts. The tree reaches 50 feet in height.

The timber is white and close-grained, and well fitted for making printing blocks or furniture, while the leaf produces a black dye when boiled in alum-water. But the main use of the tree is for tallow.

The tree, when cultivated, is grown either in plantations or transplanted to the borders of fields or canals, so as not to interfere with the cultivation of the soil. It begins to bear when

seven to eight years old, arrives at maturity in about ten to twelve years, and continues to bear seeds till from seventy to one hundred years of age. The tree fruits abundantly, and the tallow envelops the seeds. These are put into wooden cylinders with numerous small holes drilled in the bottom, and steamed for a few minutes to soften the tallow; they are then poured into mortars to be gently pounded with stone mallets in order to separate the tallow, which forms cakes weighing about 50 catties. In another process the whole seeds are simply ground up, steamed, placed in a press, and the tallow extracted, while the refuse cakes are used for manure. If crushed in this way with the seeds, the quality is greatly deteriorated and the cheeses contain elements difficult to remove.

Yield: One tree yields on an average from 20 to 30 catties of seed, and one picul of the berries produces 22 or 23 catties of tallow and 15 to 16 of oil, though as much as 30 catties of tallow is yielded in some parts.

Uses: The tallow is used for the manufacture of candles, a layer of wax being placed over the tallow body to prevent too rapid melting.

Priests use these candles for ceremonial purposes, as they object to employing animal tallow. The tallow is of greater consistency than the oils used in candle-making, and is of excellent burning quality, giving a clear, bright flame and being inodorous.

TEAK.

TECTONA GRANDIS.

There appear to be no teak forests in the limits of China, though the trees may perhaps be found isolated. The traveller Gill states that he saw teak growing north of Lat. 24° N. in Yunnan, but the first large forests do not occur until Kengtung, a British Shan State, is reached; and the zone of good teak is said by Mr. Consul Black [1] to stop at the limit of the Menam watershed. However, further investigation may prove that teak does flourish on Chinese soil.

T'UNG TREE.

ALEURITES CORDATA, M. Arg.

The following extract is from the *China Tribune*, a Japanese paper published in Tientsin, which contains valuable commercial notes: "The

[1] *Geog. Journal*, vol. viii.

oil from the nuts of the tung shu tree—best known to foreigners as wood-oil or nut-oil—has within the last few years become of considerable importance as an article of export from Hankow. The tung shu or wood-oil-tree has been styled, and worthily so, the "national tree of China," because of its stately appearance, with its green, smooth bark and spreading branches, which make it one of the finest of shade trees. It has many local names throughout the provinces in which it grows, but it is agreed generally that it belongs to the family of Euphorbiacae. The tung shu flourishes more or less in every province in the Yangtze valley. It extends from latitude 25 deg. to 34 deg. north, and from the coast to near the western part of the province of Szechwan, including an area of over 750,000 sq. miles. While it grows as far north as 24 deg., and perhaps farther, the trees growing in places in these higher latitudes are sheltered by mountain ranges on the north. Some say that the tree will flourish in a climate 20 deg. above zero, and will not be injured after the first year, but it will not bear nuts. No degree of heat in China injures the tree. It is deciduous, shedding

in October and November its leaves, which are very large and cordate. The tree blossoms in March, the flowers being red, white, or purple. The most frequent way of producing trees is to plant the seed in boxes or garden beds. When the shoots are about a foot high they are transplanted, as a rule, in clayey or gravelly soil on some hillside, along the hedges of a road, in cultivated land, or as shade trees on waste land. At first when transplanted the roots are kept moist until they have well started to grow, after which no attention is demanded. The tree is never budded or grafted. The sprout is grown by pulling or cutting off the tree a twig, the large end of which is curled up and set in any kind of sandy or clayey soil and surrounded by wheat grains, watered plentifully, and allowed to grow for a year. The shoot is then cut off above the ground, and a large sprout springs out and grows very rapidly. If kept constantly moist at the roots and well pruned, it will grow ten feet in one season, and in five years will have grown to a handsome shade tree. When not watered it grows more slowly. Other crops are not planted between rows of the trees.

After beginning to bear they appear to stand the drought of the hot summers without injury.

"The age when the tree begins to bear depends to a considerable extent on the richness of the soil and the amount of moisture it receives the first few years after planting. In some localities it produces fruit in three years, usually from the fourth to the sixth year. The tree continues to bear for about ten years, and if properly attended to and pruned would no doubt retain its productive power for a longer period. On the tree the fruit, about the size of a small orange, resembles large hickory nuts, and when ripe the buds, which have fine segments, burst open, especially if there is a frost, and one or more of the seeds fall out. The husk has three fibrous partitions, each containing a seed, which resembles somewhat the triangular Brazil nut in shape and colour, but is much smaller. The shell of the seed is slightly thinner, and the meat is similar to that of the Brazil nut. When gathered and dried, the nuts are placed in large iron pans, called "kuo," about two feet in diameter, and are stirred about over a good fire

until parched. This causes the husks to open, and the seeds are easily extracted, after which they are ground into a fine meal by hand or by rollers.

"The usual way of doing this is as follows: The nuts are placed in a stone trough, built in sections, several feet in diameter, and are ground by a heavy stone roller, turned by a buffalo, cow, or ass. The meal is then collected and put into a press, somewhat similar to the old-fashioned cider-press, wedges being driven in to increase the power, and heavy stones are piled up to make the press more effective. The oil is collected in vessels, is heated (if the weather is cold it thickens or coagulates), and after being freed from sediment by straining through coarse grass-cloth, is ready for market. Steaming the meal is practised by the natives in order to extract the liquid more easily. The oil is of a light straw colour; it turns dark brown if the process is continued, becomes black and as thick as molasses. Obtaining the oil might be greatly facilitated by the use of proper machinery. The oil is very poisonous when fresh. A simple native remedy for persons

poisoned by it is to boil a quantity of pine shavings in water and bathe the poisoned parts repeatedly. This gives immediate relief and a rapid cure.

"The refuse of the nut is used as a fertilizer, or after the oil is extracted the meal is burned to a fine ash or soot, which is mixed with wood-oil to make a paste or 'chunam,' used as a kind of cement for caulking native boats; it is also commonly used in preparing floors for the first coat of paint. So-called Chinese or Indian ink is made from the soot. In the West of China (Szechwan, Kweichow, Yunnan) the people spin thread from the fibre of the tung-tree, and make a kind of fabric that resembles woollen cloth. It is very common in Central China, and is also well known in Japan. There is also a kind of bastard wood-oil-tree, from which string can be made.

"According to a report from an American Consul, wood-oil-trees average only about 20 feet in height and 7 to 10 inches in diameter, though some are said to reach a diameter of 2 feet. The scarcity of timber in China necessitates their use, the timber being

hand-sawn. The latter is light, soft, and smooth-grained when first cut, but when seasoned is hard and durable. The wood is white, impervious to moisture, and is not liable to warp or crack even when exposed to intense heat. It is used in the manufacture of musical instruments, trunks, oven-covers, fine boxes, etc., and also for the framework of small Chinese houses. It is said that insects avoid the wood, and that for this reason it is very valuable in China, where white ants and other insects destroy woodwork often in a very short time.

" The light, straw-coloured, or light yellow oil is the only kind that has been exported to any great extent, but the two other kinds, the brownish-coloured oil and the black oil, are used quite extensively in some districts in China. The oil is used in polishing the woodwork on native boats of all kinds, as they are not painted. It is a preservative, giving the wood a bright, clean, light yellow appearance, and making it impervious to moisture. The oil mixed with quicklime makes a very good glaziers' putty, used extensively by the natives. It is used as a dressing for leather,

and in lamps, but not nearly so much as pea-nut or tea-oil. It is also used as a varnish for fine furniture, and for soap-making, and is mixed with colours for various kinds of painting. The yield is 50 lb. to the tree. The oil yield of the nut is about 40 per cent."

The above account is so exhaustive that there is little to add to it. The culture of the t'ung is a very good complement to Chinese agriculture, as the tree will grow on the sides of precipices and in any impracticable corner where it is a marvel that vegetation of any kind can exist. When the green fruit, which resembles a small apple, is plucked, it is collected in heaps and covered with grass or straw, the heat thus generated soon rotting the fleshy part, and permitting the kernels to be disengaged from the shell. There are three kinds of nuts—the yellow, from a red flower; the drab, from a speckled flower; and the white, from a white flower; the last gives the most oil, which is also the most durable. The pith of the trees is used in N.W. Kwangtung to make hair ornaments, and in the wilder parts of the west the husks are burnt for potash, and the nuts themselves, where no oil

is produced. For lighting purposes the oil is very dirty. The best qualities are said to come from Tungjen, in E. Kweichow, and from Hungkiang, in Hunan.

Other varieties of the wood-oil-tree exist in China, which include (as mentioned in the *China Tribune* article) the tung yio, the " tsi-tree," yielding oil from wood, bark, and nut ; the " muh oil-tree," flourishing best along streams ; the " chow oy shoo," limited to good soil, and having a white flower ; " haitung," or sea-oil, a spinous variety, the bark of which is used for medicine ; " ts'ing tung," or green wood-oil-tree ; " peh tung," or white wood-oil-tree ; " chi tung," or red wood-oil-tree ; " wu tung," a local name ; " yiu tung," or oil-tree ; and " pai yu." But the " tung shu " appears to be the only one known in many localities, and from the best information which it is possible to obtain, most of the oil exported is produced from its seeds.

Mr. Wilson's researches show that there are two species of Aleurites—A. montana (*Mu-yu-shu*) in South China, common near Wuchow ; while the wood-oil tree of the west and centre is A. Fordii (*T'ung-yu*), which is hardier and

more widely distributed. In Fukien the two species meet.

VARNISH TREE.

RHUS VERNICIFERA, D. C.

Chinese Name—Chi.

In the Imperial Institute Bulletin No. 1 of Vol. VIII. an account of the natural varnishes of China and Japan is given as follows :—

" The tree which yields the lacquers of the Far East is the Chi (*Rhus vernicifera*, D. C.), a deciduous species with graceful imparipinnate leaves, sometimes cultivated in England as an ornamental tree. It is native to China, and, like the art of lacquering, was introduced thence to Japan in very early times. The varnish-tree is found wild in woods, and is also cultivated along the margins of fields. Abundant in Central China, especially in the mountainous areas of Western Hupeh and Eastern Szechuan; it is rarer in western regions. It has an altitudinal range of from 3,000 to 7,500 feet, but is most frequently met with at about 4,000 feet elevation.

" The trees are the property of the owner of the soil and do not belong to the tenants who

hold the land; the varnish which they yield is also claimed by the former.

"When the tree has attained a diameter of about 6 inches tapping for varnish commences, and this operation is continued at intervals until the tree is fifty to sixty years of age. If the tapping is too severe or the trees too young, injury or death is liable to result. The tapping commences in June or early July, at a time corresponding with the opening of the flowers, and is continued throughout the summer. Oblique incisions from 4 to 12 inches in length and about 1 inch in width are made in the bark of the tree down to the wood, and the sap which exudes is collected in shells, bamboo-tubes, and similar receptacles. Pegs are driven into the trunk of the tree to facilitate climbing in order to reach the larger branches. The tapping is done early in the morning, and the sap is gathered from the receptacles into which it has flowed from the cuts each evening. At first greyish white, the varnish quickly oxidizes on exposure to the air, and becomes brownish black. To prevent contact with the air, it is usual to cover the crude varnish with layers of oiled paper. The sap continues

to exude from the wound for about seven days, and then a fresh slice of bark is removed, which causes another exudation. This is repeated seven times, with an interval of about seven days between each operation, so that the work on each tree occupies about fifty days. After being tapped the tree is allowed a period of from five to seven years to recover, and then the old wounds are reopened or fresh ones are made.

"Enormous quantities of this varnish annually pass through the port of Hankow, and this in addition to that used locally. Chinese varnish is, however, frequently adulterated by the addition of t'ung, or wood-oil. The bulk of the export goes to Japan." From half a catty to one catty is obtained from each tree. The Chinese use the varnish to lacquer shop-signs, furniture, ornaments, and the interiors of rooms in wealthy houses. The sap becomes too liquid for use if kept for over a year.

Wilson states that this Rhus verniciflua is from 25 to 60 feet high, and its altitude ranges from 3,000 to 7,500 feet, the optimum being from 4,000 to 5,000 feet.

Rhus javanica (*Pe-fu-yang-shu*) produces the

nutgalls called wupeitzu. In Yangtze valley to 3,500 feet.

Rhus Potaninii (the *Ch'ing-fu-yang*) produces the galls called ch'ipeitzu, which are used in medicine, and may perhaps yield an indelible black ink (Wilson).

WALNUT.

JUGLANS, sp.
Chinese Name—Ko tiao.

In Eastern China the walnut does not appear to occur south of the Yangtze, nor, indeed, in the Great Plain, but it is much cultivated in North China, having been noticed by the old Portuguese naturalist Loureiro, and is found in all the western provinces, and on the borders of Tibet. In Yunnan, etc., the nuts are a staple, and the oil is extracted for use in cooking and salads. In Szechwan the wood is used for heavy furniture, but where thin boards are required it is said to be unserviceable. Stocks of rifles are made of this wood at the Chengtu arsenal. This tree appears to approximate to Juglans regia, L., and, indeed, the original home of the walnut is now believed to be W. China.

In N. Manchuria and the Amur region Juglans manchurica is found between the Bureya Mountains and the Komar River, where, growing in deciduous and mixed forests, it attains a height of 60 feet, with a diameter of 2 feet, being bare of branches for 30 feet, and having a straight trunk. The wood is very hard. Juglans stenoptera, Max., similar to the above, is restricted to hilly tracts, and does not occur on the banks of the Amur.

In S. Manchuria Juglans Sieboldiana, Diana Maxim., is called the hu tiao or chiu by the Chinese, and is one of the most valuable of the deciduous trees there. Unfortunately, it is becoming scarce. It grows to a height of from 60 to 70 feet. In Kirin, on the Sungari, it is described as growing in valleys with maple and poplar, and not in groups; but on the Yalu it is found on the hillsides as well as in valleys. It flourishes most on the middle course of the Yalu and on the Hun.

Colour of wood: when young, white; when older, light brown, both in heart and sap-wood.

Quality: hard, strong, and elastic; does not bend or warp; very glossy when polished.

Uses: for good furniture and fine woodwork, trays, clogs, gun-stocks, etc., and for building. Has been largely cut and is hard to obtain. The price is Tls.3 per 10 cubic feet at Antung.

WILLOW.

SALIX.

Chinese Name—Yang.

The willow—from the willow-pattern perhaps the typical Chinese tree to Westerners—is scattered over the whole country from Manchuria to Turkestan, in the milder valleys of Tibet and in the extreme south, and a dozen species are known. From its rapid growth and the fact that it will grow where nothing else will it is of considerable importance to the people. Apart from its use as a shade-giver and wind-break, the chief use made of the tree is in the basket industry. In the north it takes the place of the bamboo for this purpose. The large baskets employed in Manchuria for shipping the wild silk cocoons are made of willow. But in Hupeh and other parts where other trees are rare, willows are used in house-building, and for smaller articles of furniture.

There are many varieties—Salix alba, L., S. pentandra, and the weeping-willow being common. In the Amur basin nine species exist, which are very useful to the natives, being used for canoes, frameworks for roofs, for ropes, chips for fires, etc. The poorer classes in China use the leaves as a substitute for tea-leaves in brewing.

ZIZYPHUS JUJUBA, Lam.
Chinese Name—Tsao-tzu.

A prickly tree in North and Central China, where it is cultivated for its fruit, the so-called date of China, which is preserved in syrup. In Shantung there are two kinds—red and black dates, one of these being perhaps the fruit of Z. vulgaris, Lam. Both trees provide durable wood, and in Fukien combs are made from it. An inferior variety is cultivated in Western China—Z. tricuspidata.

The following additional list includes a number of useful but mostly little known trees, found chiefly in the centre and west of China :—

ADINA : the button-tree of E. Szechwan ; grows 60 feet high.

CHINESE CHESTNUT.

(Aesculus Chinensis.)

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BOSWELLIA, from which a resin is obtained: used in making incense; grows in N.E. Fukien.

CHUKRASSIA TABULARIS, A. Juss.: a hard and heavy wood of the south.

CORYLUS COLURNA, L., the hazel-nut: used to make cheap furniture in Szechwan, S. Shensi, and S. Kansu.

CRATOEGUS, the hawthorn: a small tree on the Amur, but large in N. China.

DAVIDIA: in Szechwan.

DIMORPHANTUS: a small tree on middle Amur.

EURYA JAPONICA, Thun.: used for turnery.

FORTUNEA SINENSIS: on hills in Central China.

HORSE-CHESTNUT, or AESCULUS CHINENSIS, of which two species are known: a large tree, widespread. (Vide illustration.)

KALOPANAX: in the west.

LAGERSTROEMIA: in S. Yunnan.

LOQUAT, or ERIOBOTRIA JAPONICA, whose fruit, the "pipa," resembles the medlar. It appears to be at its best in Szechwan. The wood, which is red, heavy, and strong, is used for balance rudders on large boats on the Yangtze. It grows to 4,000 feet,

both wild and cultivated, and attains a height of 30 feet. (Wilson.)

MAACKIA AMURENSIS: on the Amur; medium-sized tree on the Ussuri River; wood brown and watered.

MAGNOLIA: wood unimportant; drug made from bark.

OSMANTHUS FRAGRANS, Lour: hard wood.

PAULOWNIA DUCLOUXII: in S. Chihli, Honan, Shensi, and Hupeh, where the timber is valued for boat-building.

PHYLLANTHUS EMBLICA, L.: hard wood, durable under water; leaves and fruit (*myrabolans*) used for tanning hides.

PLANERA, which is limited to the Caucasus, Crete, and the United States, occurs in N. China.

SALLOWTHORN: grows 50 feet high in W. China. (Wilson.)

TAMARIND: in the Shan States of S. Yunnan (Orleans).

TAMARIX: occurs on the Yellow River in Shensi, and forms jungles in Turkestan.

TERNSTROEMIA JAPONICA, Thb.: a hard wood.

TULIP-TREE, or LIRIODENDRON: in the west.

VATICA CHINENSIS, L.: a hard wood.

WIKSTROEMIA VIRIDIFLORA, Meissn.: furnishes paper in S.W. China, and occurs as far north as Szechwan.

ZANTHOXYLUM PIPERITUM, D. C.: the small black, dried seed is the Chinese pepper, a condiment used in Central China.

ZELKOWA ACUMINATA, Planch.: said to occur in W. Szechwan.

FRUIT-TREES.—China produces most of the fruits indigenous to temperate and sub-tropical regions, and some fruits peculiar to the country, such as the lichee, kumquat, and wampi. The best districts for temperate fruits are S. Manchuria, which should before long become well known for its produce; Shantung, where, however, the fruit has recently deteriorated in quality; S. Shansi and Shensi, with splendid orchards; the Yunnan plateau. For oranges and similar fruits Szechwan has a reputation, but all fruits grow well in the wonderful Red Basin. Fukien produces pumeloes, the Kwangtung delta bananas, olives, lichees, etc., and Hainan tropical fruit in abundance. For detailed treatment of Chinese fruit-trees Mr. Wilson's *A Naturalist in Western China* should be consulted.

SECTION II

CONIFERS

ARBOR VITAE, or THUJA: in Chekiang, Hupeh, etc.; comparatively rare, but small forests are found in W. Szechwan, and magnificent specimens exist scattered. The leaves and wood are used in the making of incense.

CEPHALOTAXUS: the name given to a species of yew discovered by Fortune in Chekiang (where it grows in valleys in the hill districts), and by David, who found the same tree in the Tsingling, N.W. Szechwan, and N. Fukien, also in valleys. The seeds are used as a remedy against asthma.

CYPRESS.

CUPRESSUS.

Chinese Name—Po.

The cypress has a very wide range in China. Fortune in his *Tea Countries of China* describes

his delight in discovering this noble-looking tree on the Tsientang River in Chekiang, where it was grown as an ornament in gardens and graveyards. Specimens of this cupressus funebris were sent to England by him in 1850. The cypress is, however, found in a wild state in many of the forests of the Nanshan as well as in the hills of far western China up to 3,500 feet. Here it is more common than pine in the rocky limestone regions. In W. Hupeh there are three varieties—viz. Biota orientalis, C. thuyoides, and C. funebris, called by the Chinese the oxtail pine. The wood is white and hard, and is highly prized for coffins on account of its durability. On the Yangtze boats are built of it, as it is light and resistant to damp. Furniture and agricultural implements are made from it, and it is preferred for building purposes to pine and fir when available. In Central and E. Szechwan the tree is very abundant, and in the Tapashan Mountains fine specimens over 100 feet are common. It is recorded that at Paoning the doors of a mosque are made of cypress which has lasted for more than two hundred years. The wood is in many districts chopped small, ground into powder, and

made into incense or joss-sticks for ceremonial purposes or to smoke out mosquitoes.

Confusion exists between the cypress and cedar in many travellers' records. The tree so called in N. China which is generally associated with tombs is perhaps the Biota or the Thuja orientalis.

Cupressus torulosa, a handsome tree of W. China, is stated by Wilson [1] to be well worth the attention of those engaged in reafforestation work in dry, warm-temperate regions. Its name, " K'an-peh-shu " or dry cypress, implies that it is suited to arid, rocky soil.

" Certain remnants of the Miocene flora which have disappeared from Europe are still conspicuous and similar in N. America," says an authority.[2] " The swanmps of the S.E. States, in which still survive Taxodium or deciduous cypress, are imitated on a small scale by the marshy banks of rivers near Canton, which are clad with Glyptostrobus, the ' water-pine ' of the Chinese."

CRYPTOMERIA : first known in 1702 in

[1] Op. cit., vol. i. p. 153.

[2] Dr. Augustine Henry in the *Encyclopædia Britannica.*

Europe, when it was named Cupressus chusanensis (from Chusan Island). It seems to be almost confined to the hills of Chekiang and Fukien, but extends possibly into Anhui. Opinions differ as to its value; in Japan it is said to be soft, feeble, and perishable, though, being very straight-grained, it opposes considerable resistance to longitudinal stress. The Chinese value it highly for pillars, and use it to make furniture.

FIR.

ABIES, etc.

Chinese Name—Sha.

There are many firs in China, but the best known is the Cunninghamia sinensis. Of silver firs the best is Abies Veitchii, Lindl., the commonest conifer on the Yalu after the pine. Its bark is greyish-white, and does not split even in old age. The tree reaches 100 feet, and has white wood, slightly tinged with red. Specific gravity: fresh, 0·73; dried, 0·34. Quality: light and soft, straight-grained, and superior to spruce. As it is very elastic and pliable, it is used to make sieves, and for door and window

frames, shingles, etc., as well as for building, telegraph-poles, masts, and furniture. It has recently come into use as raw material in paper-making and in the match industry, and for Japanese braid-shaving.

Other silver firs in Manchuria are A. holophylla, Max., and A. nephrolepis, Max.; and A. Sibirica (or pitch fir) on the Upper Yalu, the Ussuri, and Amur, above the Bureya. The last grows only in coniferous forests, but the others with deciduous trees. A. Sibirica, which grows to 50 feet, is used in building, but the wood is of poor quality.

Abies Schrenkiana is, with larch, the chief tree in the forests of the W. Tienshan, and flourishes also in the E. Tienshan, above 5,000 feet altitude. A. pectinata, of Siberia, occurs in the Altai, and a similar tree was identified by David in the Tsingling.

David states that he saw four firs in the forests of W. Szechwan, but they have not been named, nor the varieties of the whole region of the Salween-Mekong-Yangtze. The common fir of China, the cunninghamia, is peculiar to China and unique, with its peculiar prickly leaves. It

was originally Abies chinensis, but is not a silver fir; the present name is derived from the naturalist Cunningham. This fir ranges over all South and Central China, but is not found on the north side of the Tsingling, and in the highlands of W. Szechwan is supplanted at the altitude of 6,000 feet by the silver fir. There are many references to this wood in old writers on China, and its handsome, smooth-grained timber is much superior to the common Chinese pine. It is the staple of house and junk construction in South China, whence, too, it is sent in large quantities to the North, as the Foochow poles of the trade. The chief supplies come from Foochow and Wenchow, on the south coast, and from Kiangsi and Anhui to the Lower Yangtze at Kiukiang, or to Hankow from Hunan. A good deal also comes to Hangchow from Anhui, and to Wuchow from Kweichow, while the North River supplies Canton and district. It is uncertain whether there are different varieties of cunninghamia. Hosie states that at Chengtu two kinds are recognized—the "fragrant" and the "oily," the latter being used for coffin-wood. In Hunan the best sha comes from the Pei River,

and has a red heart. The bulk of the timber exported from all the forest regions of the Nan-shan appears to be from this tree. One advantage which it possesses is that it is not attacked by termites so long as it has not been injured by damp; but, on the other hand, it is not suitable for match-making. The sha is not such a hardy tree as the pine, requiring more rain, and it thrives best on great mountain-sides. The railway companies use it for piling and the rougher style of buildings (for which purpose it costs about the same as the imported Japanese or Oregon pine); but it is economical to saw it into planks. For foreign buildings even foreigners living near the timber districts find it more economical to use imported timber.

At Hankow there are three standard sizes—46-feet, 40-feet, and 36-feet logs respectively—but throughout China it is becoming more and more difficult to obtain the larger poles. Trees that are accessible are seldom allowed to grow more than 50 to 70 feet high, and at Shenchow, Hunan, it was recently found very difficult to replace a pole 80 feet in height needed as a

signal-post. In the wilder regions—e.g. of W. Hupeh or W. Szechwan—specimens 120 feet high are common.

Good charcoal for making gunpowder is obtained from the sha, and parts of the tree are used in medicine as stimulant, tonic, or sedative remedies.

Prices: There has been a great increase in prices of late years. On the coast, as at Shanghai or Canton, the timber, if bought in large quantities, costs, according to quality, from Mex. $0.40 to 0.80 per cubic foot, larger poles of course costing more. In Szechwan a log about 30 feet long by 6 inches diameter at base costs Tls.1 to 2, or on an average only a quarter of the price on the coast; but for a pillar 50 or more feet high fancy prices are paid even in the interior.

The most valuable form of cunninghamia is the "long-buried" or scented fir, which is excavated from the "wood-mines" in W. Szechwan and parts of Yunnan. The people probe for this wood with iron bars, and it is in great demand for coffin-making, being almost imperishable; it is the only wood sent east from

these distant regions, and a large log sometimes fetches as much as Tls.1,000.

The handsomest conifer in all the Far East, according to Wilson, is the silver fir named Abies Delavayi (Chinese name Lien Sha—the "cold fir"—signifying that it is found only in cold regions). It grows well in the Tibetan Borderland, beginning on Mount Omei, for instance, at 6,000 feet and reaching its maximum size between 8,500 and 10,000 feet, where many specimens reach 100 feet in height. "The timber is soft and not very durable, but the large size of the logs renders it most serviceable," [1] and it is largely employed in house-building in Chengtu. Another silver fir—the scaly-barked (*Abies squamata*)—is found in the same region, where it ascends to 12,500 feet. With its purplish-brown bark it fully equals Abies delayayi in beauty.

Altogether, nine species of silver fir are enumerated by Dr. Sargent in China proper.[2]

Pseudo-larix, originally named Abies kaempferi, was first discovered by Fortune in the hills

[1] *A Naturalist in China*, vol. ii. p. 19.

[2] Fokienia is a rare Chinese conifer.

of Chekiang, but is also well known in S. Anhui. Its height is 120 to 130 feet, and its leaves are deciduous. The Chinese name—golden pine—is derived from the rich yellow appearance which the ripened leaves and cones assume in the autumn. It is found scattered or forming woods alone. This tree is peculiar to China, having become extinct elsewhere.

KETELEERIA is another conifer peculiar to China.

JUNIPERUS CHINENSIS, L.
Chinese Name—Tzu sung.

The prickly pine is a common ornamental tree on tombs at Peking and in the Great Plain. The juniper of the mountains, e.g. the Tsingling and W. Szechwan, is a different variety, growing larger and furnishing good timber. In the Tibetan region it exists as a shrub where other trees are scarce, or forms dense forests of tall trees. In N. Turkestan J. pseudosabina yields good timber, and has a wide distribution.

Altogether six species are known in China.

LARCH.

LARIX.

Chinese Name—Lo yeh sung (deciduous pine), or Huang hua sung (yellow-flower pine).

In Manchuria, Larix leptolepis, Gord., is said to be identical with L. dahurica of Siberia. On both the Great and Little Khingan Mountains it abounds, forming, indeed, the chief component of the forests on the Upper Amur (as also on the lower course of that river, though not in the middle). Though not exceeding 60 feet in height there, the tree reaches 120 to 130 feet on the Sungari and Yalu. Here, in the neighbourhood of the Ever White Mountain, there are large forests composed entirely of larch, which seems to thrive in the volcanic soil prevalent. In the Sungari basin it is said to be less common and expensive, as it is found only in the depth of the forests.

Quality: Colour of wood—sapwood, white; heartwood, light brown. Sp. grav. fresh cut, 0·75; dried, 0·63. The hardest coniferous wood, it is also easy to work, and as it withstands damp well, it is used for exposed parts of buildings. As sleepers it lasts for twelve years—

LARCH TREES.

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i.e. double the time of ash and maple. The Chinese use it chiefly for coffins, masts, pillars in temples and large mansions, but not for ordinary dwelling-houses. It is also very popular for shipbuilding throughout the Far East, being considered much superior even to Oregon pine." The resinous heartwood is used for handsome tea-trays and tobacco-boxes. The larch is also largely employed for telegraph poles.

Price: Tls.3 to 5 per 10 cubic feet. Output on Yalu, 80,000 cubic feet.

The larch is found in Kiangsi and other parts of the Nanshan region, and in the Tsingling. On the upper waters of the Yangtze, Mekong, and Salween, L. Mastersiana forms great forests, and is one of the last trees to die out—at 14,000 feet—as on the opposite slope of the Himalayas. It is one of the chief components of the forests in the Eastern Tienshan Mountains, and L. sibirica, which goes farthest north of all conifers in Siberia, is found in the Altai.

In N.W. Szechwan, L. Potaninii (the *Hung-sha*) is the tallest of all the conifers, and its timber is much valued.

PINE.

Chinese Name—Sung.

The different species of pine in the Chinese region appear never to have been classified. David, in 1872, stated that there are three pines in China, viz. P. sinensis, P. maritima, and P. Bungeana.

The third of these is unique; it is a splendid tree, with white bark, and often grows to an immense size, adorning tombs in Central Chihli, to which district it is almost confined. It also occurs isolated in a few localities in Shantung, as in the district sacred to Confucius.

P. sinensis, to which David gave the alternative name of longifolia, is found all over China proper, where it is named the horse-tail pine. It appears to resemble very closely P. densiflora, S. *et* Z. of Japan, and is used almost exclusively for fuel. The tree grows in the most barren soil, but is always stunted, being deprived of its branches and subsequently cut at an early age for firewood. Its dark foliage is a characteristic of most landscapes, almost every village having a plantation near by.

WHITE PINE OF CHIHLI.

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P. maritima, also named quinquefolia by David, is perhaps identical with P. Koraiensis, S. *et* Z., which in turn is stated (in a Japanese report) to be the same as P. Manchurica, Rupr.

This variety, proper to the mountains of the interior, grows into a fine tree. P. Manchurica (sometimes named the cedar by Russians) grows in abundance in Manchuria, extending from the Bureya Mountains over the Russian territory, and attaining a height of 70 feet, from which deals 56 feet long are cut. Parcels of this timber have recently been shipped to England from Vladivostok. P. Koraiensis, the same red pine, is the most important timber in the Sungari forests, with strong wood of good grain. Here and in the Yalu forests it grows to a height of 80 feet, with a maximum diameter of 4 feet, the first branches being from 40 to 50 feet from the ground. It is said to be the most common conifer in these forests, and furnishes 30 per cent. of the timber exported from the Yalu. It grows in valleys as well as on the hills, with other conifers and deciduous trees. The wood, which is white with a shade of light red, is used in house and junk-building, for coffins, for coarse

furniture, and by the Japanese in Manchuria, especially for window-frames and ceilings; it was formerly thought to be only equal to the inferior Japanese pine and "Oregon pine," but is now conceded to be as good as Japanese red pine on account of its close grain and the readiness with which it is worked; 60,000 to 80,000 logs come down the Yalu yearly, but the larger sizes are found on the sources of the Sungari. The supplies, where accessible, are being rapidly depleted.

In South China the same pine is inferior to the northern wood and to the fir, or cunninghamia (q.v.). It is used for flooring and for piles sunk in the ground where the foundation of a house is to be laid, or under water; for these purposes it is said to be more durable than fir, but generally it is deficient in strength, more susceptible to the attacks of termites, and more liable to rot than the latter. For props in mines it is suitable, and the establishment of cigarette factories in China has created a demand for the wood to make cigarette cases. The seeds are edible, and are eaten in Manchuria, Szechwan, and the Nanshan, where forests still survive;

these seeds are also a delicacy of the Siberian peasants in the Yenisei region.

Another variety is P. Massoniana, Lamb, found in Szechwan, chiefly in the east of the province, and supplying wood for house-building and furniture; the soot from the wood, when burnt, is used for dyeing native cloth, the dye being made with a mixture of millet spirit and water.

Of other varieties, P. funebris, Komarov, has been identified in Manchuria; the Cembran pine grows, but only in a stunted condition, on the Amur, and perhaps in the great unexplored forests of N. Manchuria; P. sylvestris abounds on the Upper Amur, but is not found below the Bureya Mountains; it is, however, particularly plentiful in the Altai Mountains on the Russo-Chinese frontier.

The largest forests are in the virgin regions of the west; many of these, if accessible, have been cut of recent years, as in the Tsingling, but on the Tibetan border vast tracts remain untouched. The altitude limit of the pine in these Alps coincides with that of P. excelsa on the other side of the Himalayan massif, and

varies between 10,000 and 12,500 feet according to the latitude—a limit considerably below that of some other conifers.

Resin.—This product of the pine has received little mention in trade reports on China, but with the diminution of supplies of resin in the United States and the increase in demand, its importance may become enhanced, and China may become a source of supply. In the Manchurian forests a valuable source of supply remains to be tapped, and as the extraction of resin does not lessen the value of the timber, the wood industry would gain by its development. It is on record (Consular Report, Newchwang, 1867) that excellent resin was then produced in the Kirin forests, and was employed to lacquer presses, boxes, candlesticks, and even coffins. In N. Kweichow resin is collected and brought to the towns on the Yangtze to cement coffins, and sometimes as much as 80 catties (over 100 lb.) weight is used for one coffin. In Hunan resin is plentiful in the Paoking pine region, and in N.E. Kwangsi extensive pine plantations are cultivated for the production of this resin, which goes down the West River.

RED PINE FOREST, MANCHURIA.

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"Pine-oil," or coarse, crude, undistilled turpentine, is produced in Kweichow by baking pine-knots until it exudes into suitable receptacles. It is practically pine-gum, and is used as a cure for various skin diseases.

Pinus Massoniana is the most widely distributed of the eight enumerated in China, and ascends from sea-level to 4,000 feet altitude, where its timber, unlike that from low levels, is close-grained, resinous, and durable. This is the Pinus sinensis above mentioned. Other hard pines are found at higher altitudes (up to 10,000 feet), including the following:—

P. Henryi, which averages 60 feet in height; P. densata, P. Wilsonii, a black pine; and P. prominens, with very resinous wood, much esteemed.

P. Armandi, the white pine, has also very resinous wood, used for torches. It is abundant in W. Hupeh, where its seeds are eaten. It is widely spread, and though its timber never attains great size, it is very durable and much used.

Fuling, or Pachyma cocos, is a fungus which is cultivated largely in Anhui and other provinces. Cuttings are made and applied to decay-

ing pine trunks, which are then covered with soil, and the fuling, a tubercle of a dirty greyish colour, becomes attached to the wood by rootlets. When it has attained a considerable size it is detached and dried preparatory to sending it to market. Large quantities are produced.

SPRUCE.

PICEA.

Chinese Name—Sha.

Several spruces exist in China, but they have only been scientifically exploited in Manchuria by the Sino-Japanese Timber Company. The principal spruce in the East Manchurian forests is Picea Hondoensis, Mayr., which grows with red and white pine to a height of considerably over 100 feet. The wood is described as "yellowish-red" both in heart and sap-wood, and is of fine grain, glossy when planed, soft, and easily split, and next in quality to red pine. Uses: for house construction, beer and tea-cases, and rice steamers. Owing to its great height, it is suitable for masts, telegraph poles of the largest size, pillars, and beams. The softness of the wood will render it useful in the paper and

match-box industries. This spruce grows also on the Sungari and the Usuri.

Picea polita, Carr., ranks below the last in quality, and grows only to 80 feet. The heart-wood is white and the sap-wood red. It is used for the same purposes as P. Hondoensis. Its specific gravity is 0·95 undried, 0·40 dried.

Picea Ajanensis, the Ayan pitch, is described by Ravenstein as growing on the Upper Usuri, and in Siberia on the lower Amur and the coast. It has also been identified on the Upper Yalu. It has a straight trunk 70 feet high by 3 feet thick, and is said to be admirably fitted for shipbuilding.

Picea excelsa is the commonest tree in the Altai, reaching 120 feet. It is also the chief tree of the Yenisei forests, where it is suitable for shipbuilding and for oars.

P. obovata also grows in these regions, and along the whole course of the Amur. It is only 50 feet high, and the wood is of inferior quality.

The spruce forms forests in E. Shensi, on the Tsingling Mountains, and on the eastern slopes of the Tibetan region in S. Kansu and W. Szechwan. Mr. Wilson mentions five species of

spruce in his "Naturalist in West China." In N.W. Szechwan the Me-tiao Sha—Picea ascendens—is the most esteemed timber-tree for general building purposes, but there are many other species (Dr. Sargent [1] enumerates twenty), including P. Wilsonii, a stately tree of W. Hupeh, where is also found the flat-leaved spruce—P. pachyclada.

Tsuga Chinensis, a species of hemlock spruce, grows to 100 feet by 12 feet girth in the Chiutiao Mountains, and in the Tsingling.

The only other species of this tree known in China is Tsuga Yunnanensis, which occurs farther west. These trees are both named Tieh Sha, or iron-fir, by the Chinese, who value their wood for planking and use it also for roof shingles.

YEW.

TAXUS.

Chinese Name—Shui sung (Water pine).

In Manchuria the Chinese have named the yew "the king of the trees" on account of its great durability. This yew is Taxus cuspidata, S. *et* Z., which extends from the south Usuri to the Yalu. Here it is not more than 40 feet high,

[1] In the Preface to Wilson's book.

SPRUCE FROM WUTAI SHAN, SHANSI.

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and unfortunately many of the old trees have decayed hearts and branches touching the ground, so that good timber is hard to obtain. The local name is red cedar, from the colour of the wood, which is hard, close-grained, and flexible.

Uses: For furniture, ornamental pillars, combs, the chopsticks of the wealthy, and for carving (it is nearly as fine as boxwood). Rich coffins and palace pillars are also made from the best specimens, which often realize fancy figures, but unfortunately the tree is becoming scarce, and can only be procured in limited districts, though it is to be found in inaccessible forests.

Taxus baccata occurs in N. Manchuria. In China proper the yew is only seen when preserved in temple or burial grounds, except in the fastnesses of the tribes in W. Szechwan.

Taxus cuspidata, var. chinensis, the Chinese Tuanch'u Sha, is found scattered all over W. China between 2,000 and 5,000 feet altitude, but is not anywhere really abundant (Wilson).

Other trees of the Taxaceae family found in China include the Torreya, Cephalotaxus, and Podocarpus.

SECTION III

BAMBOO

FORTY species of bamboo, cultivated or wild, have been named. The plant has a very wide range. From the mountains of the Tibetan borderland, where it is seen weighed down by snow, to the jungles of South China, it is a prominent feature of the landscape, and groves of cultivated bamboo flourish in N. Honan, where, indeed, when the climate was less dry, the plant grew in the wild state. Its northern limit is now southern Shensi and Kansu. In Szechwan it is ubiquitous, and it occupies the first place among woods used in carpentry here and southwards for the most part.

Whether as a giant tree or an insignificant shrub, the bamboo is a most useful economic plant, of which every part is of service to the Chinese, who, indeed, would find difficulty in

supporting existence without it. No better list of its uses has ever been penned than that by Dr. B. C. Henry,[1] which the curious may care to read here: "The multiform uses of this wonderful plant are amazing. Houses may be built of it, the heavier trees standing as pillars, and making good rafters; the split canes in broad sheets woven with wattles form the sides, or cut into halves make the floors; the door of the same material, fastened with bamboo-thongs, and locked with a peculiar bolt of the same wood; while the roof is composed of bamboo-thatch, which is perfectly impervious. The furniture, in the form of stools, chairs, tables, couches, pillow, is all of bamboo, while cups, water-pails, ladles to dip out the rice, and wrappings for cakes of various kinds are of the same material. The fuel for the clay furnace, and the young sprouts stewing in the pot, are from the same root. The mats to sleep upon, the lattice that forms the windows, the ladder to ascend to the loft, lamps to light the room, and lanterns to hang outside the door are all of bamboo. Rafts on the river, for fishing or transport, bridges

[1] *Lingnam*, p. 111.

across streams, yokes for cattle, water-pipes, 4 and 5 inches in diameter, and the long cups, placed in circles round the great water-wheels, which pour the stream into the field, are from the same plant. Watch-towers in the city, great sheds erected over buildings in course of construction, the framework of theatres, rain-spouts, tent-poles, spear-handles, dry and liquid manures are all of this material. Cloth for garments, hats, caps, cuffs, shoes, umbrellas, tobacco-pipes, both stem and bowl, show more of its uses. In many boats the roof is made of bamboo lattice, with leaves of the same plant interlaced. The poles for pushing, the ropes for tracking and rigging, the mast and oarlocks are of bamboo. Window-blinds, curtains, brooms and their handles, brushes, desks, boxes, and frames of all kinds are made with it. Baskets of all sizes, from the tiny toy to the great receptacles for grain that will hold a ton or more, baskets for carrying pigs, big and little, for ducks, geese, chickens, all in different shapes, bird-cages, cricket-traps, snares to entrap partridge and quail, hampers to carry provisions are made of bamboo; tubs, and the hoops around them,

knives, incense-boxes, hairpins, combs, hat-strings, jugs, teapots, paint-boxes, spoons, and suchlike are produced. The fisherman finds his raft, his net, his dredge and its long handle, his anchoring-post, his floats, and baskets, of various shapes, for catching fish, shrimps, crabs, etc., are all of this material. The scholar uses pen, paper, scroll, and tablets; the soldier his spear, arrows, bow, shield, military hat, torch, splints for wounded limbs, shovels and spades for excavation; the magician his divining slips, lathes, and tokens; the gambler his tickets—all of this material; while canes, flutes, cow-bells, castanets, silkworm-frames, fans—handles and frames—gates, fences, sieves, scoops, pot-handles, and drying-poles extend the long catalogue. Pins, tubes, probes, props for fruit-trees, carrying-poles, sedan-chairs, money-boxes, weaving-frames, sofas, trays of all sizes, from 2 inches to 6 feet and more in diameter, awnings over streets and before houses, chopsticks, flower-pots, girdles, hedges, books, and various other articles are made from this most useful plant."

Giant bamboos, 80 feet in length, are made into rafts on the Ya River, in Szechwan, and

elsewhere. Each pole is heated and has its end turned up in front, and, as they are hollow and full of air, they can carry great weights and pass over bad rapids in safety. In some parts the rind is peeled off and the bamboos varnished previous to use for rafting. Another very economical use to which bamboos are put is in the formation of hedges; the intertwined stems are impenetrable, and take the place of mud or brick walls, which are far more costly. "In Yunnan the Shans construct houses of bamboos, which are soaked for weeks to harden them and prevent the attacks of boring insects. For an ordinary house sixty to seventy large bamboos and a hundred small stems are required, costing from £6 to £10." [1]

Bamboo takes an important place in the arts in China; it is largely used, for instance, to make screens, which are handsomely carved and ornamented. Bamboo sheeting is used in the manufacture of fretwork tablets, mirrors, etc. But one of the chief uses of bamboo is for providing paper of all kinds—whether the finest writing material or the coarsest wrapping paper.

[1] *The Shans at Home.*

For these purposes it is largely manufactured in all the southern provinces, but perhaps especially in Central Kiangsi and S. Fukien. Improved methods will become necessary in this important industry, in view of the increasing importation of foreign paper, which is superior in strength and cheaper, at least for certain purposes.

The value of the bamboo to China cannot be over-stated; it would, indeed, be difficult to imagine how existence could be sustained in the south without this indispensable plant.

PALMS.

Seven genera and fourteen species are known in China, but the most important palm economically is the coir-palm, Trachycarpus excelsus, H. Wendl., which is common on the Yangtze, in the southern provinces, and in the lower parts of Yunnan. It is a hardy plant, withstanding the frosty winters of Kiangsu, and has been cultivated in England, where it was introduced by Fortune. Its large brown bracts are natural pieces of fibre cloth, and resemble coco-nut fibre, but are superior to the latter. The tree averages

10 or 12 feet in height, and yields over a catty of fibre, which is woven into mats, rain-coats, capable of lasting for two or three seasons, covers of trunks, the uppers of rain-shoes, etc. It provides also brushes and brooms, and ropes which last for a long time even under water. The stems are used in country districts as pillars for doorways, and the tree is used as an ornament for gardens. Considerable shipments of coir are made from Wenchow (Chekiang) and other ports, and down the Yangtze from Szechwan.

Livistona chinensis, R. Br. Chinese Tsung lu, is restricted to a limited area in the West River delta S.W. of Canton. It is the fan palm, which is carefully cultivated for its leaves, which furnish the well-known fans of South China. The fibre is removed after five years' growth, and used in similar ways to that of the coir-palm. Hats are made from the leaves of inferior trees. When full grown this palm is 30 feet high.

A species of caryota is cultivated in Kwangtung and Kwangsi—as an ornamental plant at Canton, but for the production of fibre on the West River. The wood is said to be hard and handsome, and is used for furniture, tools, and

COIR PALM AND CATALPA.

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hoes, and furnishes very good sedan-chair poles. The trunk makes good pillars, or if split in two is used for waterspouts.

In Hainan Island, which is tropical, there is an abundance of palms. The Areca catechu, or pinlang, is highly prized for its nuts, which are superior to those of the Malay States, the latter being imported to adulterate the Hainan product. The coco-nut palm is also cultivated in the island and on the Leichow Peninsula opposite, the shell, the kernel, and the fibre being made use of, though ropes are not made from the fibre, as other palms provide a better quality. Palms grow well in S. Yunnan also, and the screw-pine (*pandanus*) yields fibre here and in Leichow, whence it is sent to Hainan for mixture with hemp to make the local fine grasscloth, or, alone, the coarse grasscloth.

SECTION IV

FOREIGN TREES

AMONG foreign trees which have been successfully introduced to China, and whose cultivation might be extended with advantage, the Plane (a curious exception in the Chinese flora) grows very well in the streets of the foreign settlements at Shanghai. The leaf appears to have developed to a larger size than in England, so that this tree is hardly to be excelled as a provider of shade by the wayside.

The Locust (*Robinia pseudacacia*) has been grown very successfully in Shantung and in the Japanese leased territory in Manchuria as a shade tree; the wood is valuable for certain purposes, such as fencing, but especially for insulator pins on telegraph posts.

The eucalyptus has also been recommended for cultivation in China; various species have

proved successful in the dry regions of California, and might succeed in North China.

Australian spinnifex,[1] which can alone combat drifting sand, might be introduced with advantage in North-West China.

[1] A grass.

APPENDIXES

APPENDIX A

RAFTS

ON THE YALU.—There are several standard sizes of rafts, as well as others of miscellaneous timber. In the most common variety the unit of 8-foot logs only is found. Each man in a gang makes 10 *fu* of eleven logs, and a gang of twenty men thus makes 200 *fu*, which become from six to eight rafts. The rafts are generally of 25 *fu* on the Hun, which has dangerous rapids, and of 30 on the Yalu. Other beams are cut to 32, 24, or 16 Chinese feet, when shorter lengths are sandwiched in between the longer pieces or laid on top of the raft. "In binding the side and interspersed middle pieces together a heavy withe or tree-branch is run through holes cut in the projecting ends, and these sections are then firmly lashed together fore and aft. In the centre of the raft a bark or thin board hut is built, while at the ends are mounted long sweeps

—four on the smaller, six on the larger, craft. To man all these the boss must hire another three or four raftsmen, who have trudged up in the spring, and in addition a captain to pilot the fleet down-stream. These sailors receive, say, Tls.20 and the captain Tls.30 to see the rafts safely landed at Antung or Tatungkow, soon or late. Arrived here, the bosses and cutters are again staked at the hong till the wood can be sold. From the proceeds must first be taken out the advances for utensils, clothes, and food, the manager's capital and interest, and the boss's, raftsmen's, and pilots' wages before the divisible residue appears. Should the proceeds fail to cover the deductible expenses, the manager's interest is held over till the next year and the cutters get only their expenses." [1] Another kind of raft is composed of forty-five beams of uniform size, 40 feet long, 2 feet 4 or 5 inches thick, and 3 feet broad. Each piece is worth some Tls.70-80. Such rafts are composed of the large varieties of pine. There are also rafts of 150 spars, measuring on an average 2 feet in diameter at base and 7 inches at the top and 45 feet long. Every such raft is worth

[1] Antung Customs Report, 1907.

A RAFT ON THE YALU RIVER, MANCHURIA.

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about Tls.500. Large numbers of spars suitable for the largest junks come down to Antung from the forests. The time they are on the water is sometimes two months, and near Hwaijen, on the Hun, six miles of rafts are sometimes seen awaiting the opportunity to pass the terrible whirlpools. Their fate is dependent on the will of the river gods, and rich offerings are made to these at the temples, whose priests are said to have great influence over the lumbermen. These latter resemble workers in the wilds everywhere, in that, as soon as they reach civilization with their wages in hand, the whole sum is "blown" in a short time, when, the summer coming to an end again, the men, who are now destitute of funds, are ready to set out again for the forests.

On the Sungari.—The construction of rafts varies on this river with the size and depth of the streams and the species of timber concerned. The conifer rafts predominate. On the lesser streams some sixteen logs of uniform length are selected and made into small rafts, and on arrival at the larger affluents of the Sungari three of

these are combined with the junction of the two chief branches of the river, where from eighteen to thirty of the small size are formed into a large *pai*, which is from 20 to 30 feet in width by 400 to 500 long, and contain from 400 to as many as 1,000 logs. As usual, a hut is built on the large rafts for the raftsmen, who number anything from six to twenty men. As the river is very wide and the current runs very slow, the journey is a long one, often taking two months in very dry seasons, and cases have been known of the rafts failing to arrive at Kirin in the same year when they were cut.

On the North River of Kwangtung.—The rafting here through the splendid Lokcheung gorges is described by Dr. Hadden, of Yungchow as follows: "Only the best of the stems are used—the lower 10 to 15 feet of them. These lashed side by side form one-layer-thick rafts, about 6 feet wide and 10 to 15 feet long. Each section contains about two dozen logs, and there is sometimes an incomplete second layer on top. A train of these comprises anything from a dozen to twenty sections, which, loosely attached to

each other, form a many-sectioned, serpentine arrangement, guided by two men, and capable of shooting the rapids with great ease. At Lokcheung three such trains are put side by side to form a raft to Shuichow, where they are made up into such huge rafts by a similar agglutination that I could scarcely believe them to go down river at all." These are the rafts described by the Macartney Embassy chronicler in 1793 as possessing masts and sails, and cabins for families. They had vegetables growing on them and domestic animals were reared; the people also had fishing-nets and other fishing-tackle.

On the Siang (Hunan).—Dr. Hadden says: "Above Yungchow the rafts are very heavily manned, and the simple methods current at Lokcheung are very different from the Hunan raft-making, with its masses of built-up timber. The type is that of a simple oblong with four large sweeps at each end, averaging twelve to fifteen men for each sweep—fifty to sixty men per raft. The size is just barely enough to hold the men and permit the working of the sweeps. Below Yungchow the same raft works with two

to six men to each sweep. The rafts are finally made up into big rafts in the region of Siangtan and below." These rafts are managed by fellow-clansmen, who share the profits. On the other rivers of Hunan wages are very low, hardly exceeding, on an average, 10 cents a day. On the Tzu River it is reported that 20 per cent. of the rafts are wrecked in the rapids on their way to Iyang.

THE YANGTZE RAFTS.—These come down to Hankow from Hunan, or to Kiukiang from Kiangsi. The former are made up from smaller rafts at the large marts on the Tungting Lake. The account of these which appeared in the Yochow Customs Decennial Report, 1902, seems worth while reproducing: "The small rafts are made into large ones, of about 80 by 60 feet, and from 6 to 8 feet in depth. From two to five of these rafts are usually fastened together, with a space of a few feet between each, for mobility in navigation. The crew, which consists of from sixteen to sixty men, according to the size of the raft, live in bamboo-houses built on the rafts, which gives them the appear-

ance of floating villas. The owner or his deputy travels on the raft, and keeps his own watchmen, who receive 800 cash per month, in addition to their food, and have nothing to do with navigation ; this is contracted for by a headman, who receives from the owner 11,500 cash for the journey from Ch'angte to Hankow. The number of the crew is fixed on the basis of four men per hundred liang measurement. The headman, however, pays only his best men at this rate, the second-class men receiving only 6,000 cash, and the third grade 3,500 cash, all inclusive of food. In the event of the journey exceeding eighty days, owing to bad weather, the owner pays the headman 120 cash per man for each extra day and supplies the food. This man is responsible for the navigation and safe arrival of the rafts at the place of destination ; the loss of any part of them must be made good by him. The headman, or drum-beater, controls the working of his large crew by the beating of a drum, the din of which is sometimes fearful when he wants to spur on his men. The rafts float down with the current ; steerage is effected by means of large floating rudders of bamboo,

run out and then hove in on the enormous capstan, placed on the bow raft, and by large sweeps. There is danger from high seas on the Tungting Lake, and the rafts also sometimes break up on a lee shore on the Yangtze in gales." These rafts are a menace to other craft on the Yangtze, though no longer a mile in length, as the rafts on the Lower Yangtze were before the river was opened to steam navigation, when the houses formed streets on them, where all sorts of handicrafts and trades were carried on, where there were barbers, tailors, shoemakers, butchers, bakers, pulse-preparers, rice-vendors, and vintners—a spectacle reserved for this remarkable people to show the world.

In Western Szechwan.—On the Min River above Kuanhsien, where timber is collected for the supply of the plains, the rapids in the gorges are extremely dangerous, and the rafts are therefore made firm but pliable. "Square sticks are fastened together into long, narrow rafts, the logs being laid overlapping each other and then fastened with bamboo-ropes, which are then driven firm with wedges. Six men are lashed

to each of the sweeps at the bow and stern. If there is an accident, even the logs are smashed, and the waves break right over the rafts, so that great nerve is required." [1] They are made up of logs of all lengths, shapes, and thicknesses, the timber generally valuing from Tls.200-300, and, besides, there is a cargo of coke, charcoal, and millstones above the gorges, where extra men are employed to pilot them through. The headman gets 1,500 cash and his assistants 1,200 for the trip to Chengtu, which is good pay. If a man is drowned, his relatives are paid Tls.30 and the river is closed for three days.

Similar conditions to these prevail on the Kinsha, or Upper Yangtze, where large rafts go down to Suifu through rapids so bad that the waves are compared to those of the sea. "Iron rings are fixed on the boards, and in the rapids the men cling to these for safety. The great danger is when the head of the raft goes down against a rock and the force of the waves dashes the keel flat up against the side. This is called 'pasting up scrolls.'" [2]

[1] *Adventure, Sport, and Travel on the Tibetan Steppes*, W. N. Fergusson.

[2] "Skirting Babuland," by S. Pollard, *East of Asia*, vol. iv.

On yet another river of Western Szechwan—the Ya—where the rapids are less formidable, bamboo rafts descend in large numbers, gliding in safety through the broken water, and supported by their buoyancy.

SQUARED LOGS ON A CHINESE RIVER.

To face p. 322

APPENDIX B

TIMBER IMPORTS INTO CHINA

In Schlich's *Manual of Forestry*, vol. i., 3rd ed., the quantity of timber imported into China is estimated at 50,000 tons annually, and this trade, existent for many years, is a growing one. The more valuable woods for ornamental work have been imported from the southern seas for centuries. Thus the Canton "blackwood" for cabinet-making is a product of the Malayan region. As long ago as 1868 a Customs Report for Ningpo mentions the valuable woods imported to that port; they were ebony, used for lamp-frames, chopsticks, and small articles of furniture; sapan-wood, largely used as a dye; red-wood, low-priced and taking varnish well, and used for furniture; and sandal-wood, for incense, etc. Throughout the coast and on the Lower Yangtze soft-woods from Puget Sound and

British Columbia—the "Oregon pine" of commerce—have been shipped to China in increasing quantities since the sixties of last century for house and shipbuilding. Japan pine from Hokkaido was imported at the same date, but considered inferior and used only for rough sheeting under roof-tiling and native floors. It is now, however, much more extensively used for constructional work generally in the large ports.

APPENDIX C

NOTES ON TIMBER IN USE BY CHINESE RAILWAYS

SLEEPERS.—In North China Japanese oak has been the chief timber in use for sleepers, though some oak and ash from the Yalu has also been experimentally tried on the S. Manchuria and German Shantung lines. On the Shanghai-Nanking Railway jarrah-wood from W. Australia, though costing three or four times as much as Japanese oak, has been proved to be more economical, since it will last for twenty years if well cared for; in addition, the oak has usually been cut at the wrong time and not properly seasoned. "Oregon pine" has not been used. In South China, New South Wales eucalyptus is exclusively used, no local woods being procurable.

CONSTRUCTIONAL WORK.—"Oregon pine" is used for all rough, squared timber structures, such as jetties, wharves, piles, coffer dams, staging, and for all rough timber work of buildings, such as roof trusses, floor joists, etc., where any large quantity of timber is required. This applies to most of the railways, whether north or south.

Chinese coniferous wood, from the Hankow market for the Yangtze valley and from Canton, Foochow, Wenchow, for the south, Shanghai, and to some extent for the north, has been used for the roughest work, such as piling, scaffolding, rough roof timber in the cheaper style of buildings, and for telegraph poles. Prices vary, but are much the same as those given for imported deal. If large quantities are required, it is more economical to procure a shipment of imported logs and saw them up as required. Again, smaller poles of the native woods are cheaper, larger ones more expensive. In Shantung and on the Chinese-constructed railway from Shanghai to Soochow some Manchurian timber has been employed, as also, naturally, on the Manchurian railways.

Appendix C

FINE WORK.—For better-class miscellaneous work, such as joinery, furniture of coaches and buildings, etc., hardwoods, such as "Singapore red-wood" (which is cheap and even used for decking of road bridges), teak from Siam and Malaya, and yacal-wood from Borneo, are extensively employed. On the French line in Yunnan, Tonking woods are available. There are practically no local Chinese hardwoods to compete with these at present, but, as shown elsewhere, large supplies of camphor-wood could be obtained, if the industry were encouraged, which would be eminently suitable for sleepers; the forests of Manchuria are beginning to yield up their wealth—perhaps at a too rapid rate; while the projects for constructing railways from Yunnan to Chungking and from Burma to Yunnan will draw upon the supplies in the western forests. On the Chengtu-Hankow line, now building, native sleepers have been tried successfully, and doubtless the railways in the interior will in time be supplied by native markets.

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